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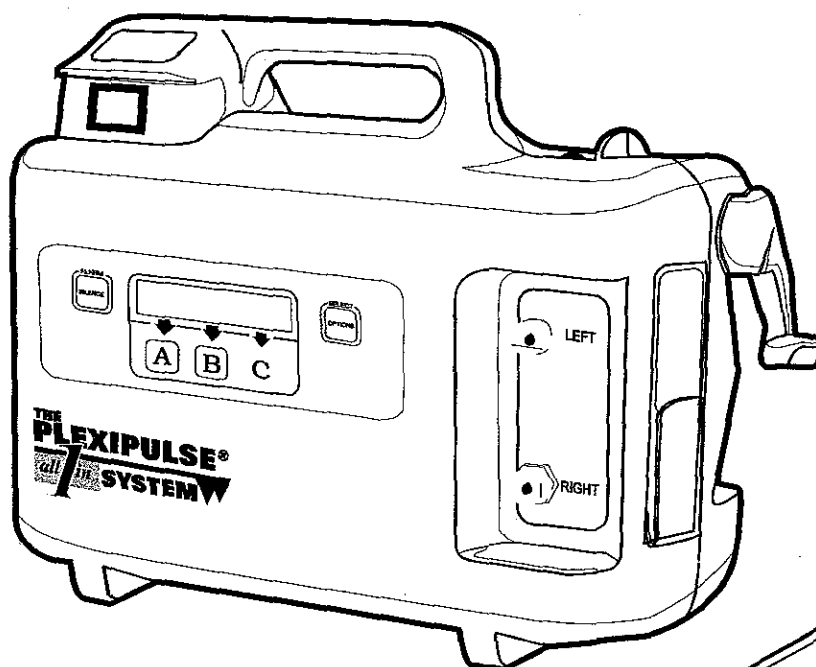
THE PLEXIPULSE®

all in SYSTEM

OPERATIONS AND SERVICE MANUAL

P/N 700507

MARCH 2000



RESTRICTED USE
Certain pages of this manual are designated "Restricted Use Only." Information contained on those designated pages may be used solely to facilitate the proper maintenance and repair of KCI products identified herein. If these terms are unacceptable, immediately remove those designated pages and return them to KCI, Attn: Legal Dept. Refer to authorized personnel for proper maintenance and repair.

KCI
The Clinical Advantage™

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FAX (210) 308-3998

The PlexiPulse® All-In-1 System has met UL544 standards. Other pumps, which are not presently UL listed, may be substituted in the future.

This manual covers three models of the PlexiPulse® Pumps, which are differentiated by the color of the Power Switch on the front of the Pump Case, and the configurations of Solenoid/Valve/Manifold Assembly or Solenoid/Valve/Fan Assembly. These models will be referred to throughout the manual as "Red Button Pump", "Green Button Pump with Solenoid/Valve/Manifold Assembly", or "Green Button Pump with Solenoid/Valve/Fan Assembly".

The PlexiPulse® All-In-1 System should be used only with PlexiPulse® Wraps.

LIST OF CURRENT PAGES

Copyright 1995, 2000 Kinetic Concepts, Inc. All Rights Reserved. This manual was originally printed for publication in August 1995. This manual has changed extensively from its original revision, please review entire manual before using the PlexiPulse® All-In-1 System. Each page in the PlexiPulse® All-In-1 System Operations and Service Manual is listed below with its current revision level and date of revision.

Page	Rev. . .	Date	Page	Rev. . .	Date	Page	Rev. . .	Date
i	Rev. B	03/00	7-3	Rev. B	03/00	8-11	Rev. B	03/00
ii	Rev. B	03/00	7-4	Rev. B	03/00	9-1	Rev. B	03/00
iii	Rev. B	03/00	7-5	Rev. B	03/00	10-1	Rev. B	03/00
iv	Rev. B	03/00	7-6	Rev. B	03/00	10-2	Rev. B	03/00
v	Rev. B	03/00	7-7	Rev. B	03/00	10-3	Rev. B	03/00
vi	Rev. B	03/00	7-8	Rev. B	03/00	10-4	Rev. B	03/00
vii	Rev. B	03/00	7-9	Rev. B	03/00	10-5	Rev. B	03/00
viii	Rev. B	03/00	7-10	Rev. B	03/00	10-6	Rev. B	03/00
1-1	Rev. B	03/00	7-11	Rev. B	03/00	10-7	Rev. B	03/00
2-1	Rev. B	03/00	7-12	Rev. B	03/00	10-8	Rev. B	03/00
2-2	Rev. B	03/00	7-13	Rev. B	03/00	10-9	Rev. B	03/00
3-1	Rev. B	03/00	7-14	Rev. B	03/00	10-10	Rev. B	03/00
4-1	Rev. B	03/00	7-15	Rev. B	03/00	a	Rev. B	03/00
5-1	Rev. B	03/00	7-16	Rev. B	03/00	b	Rev. B	03/00
5-2	Rev. B	03/00	7-17	Rev. B	03/00			
5-3	Rev. B	03/00	7-18	Rev. B	03/00			
5-4	Rev. B	03/00	8-1	Rev. B	03/00			
5-5	Rev. B	03/00	8-2	Rev. B	03/00			
5-6	Rev. B	03/00	8-3	Rev. B	03/00			
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7-1	Rev. B	03/00	8-9	Rev. B	03/00			
7-2	Rev. B	03/00	8-10	Rev. B	03/00			

For questions or comments about the content of this manual, please contact the Technical Publications Department at: Techpub@kci1.com. Please note, this email address is for issues concerning the literature only. Please contact KCI Customer Service 1-888-ASK-4KCI (1-888-275-4524) for issues concerning the product and its use.

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Rev. B 03/00

CAUTION

Federal Law restricts this device to sale or rental by or on the order of a physician.

This PlexiPulse® All-In-1 System Operations and Service Manual is not a guarantee or warranty as to this product. It is intended only as a user's guide. For additional information or for specific questions, please contact KCI Customer Service 1-888-ASK-4KCI (1-888-275-4524).

In order for KCI products to provide safe and proper performance, the following conditions must be met. Failure to comply with these conditions will void any pertinent warranties:

- It is strongly recommended that all assembly, operation, adjustment, modification, maintenance and/or repair be carried out by qualified personnel authorized by KCI.
- The electrical installation of the room must comply with the appropriate electrical wiring standards.
- The product must be used in accordance with the corresponding Operations and Service Manual.

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The PlexiPulse® All-In-1 System offers a therapeutic edge in foot and leg compression. PlexiPulse® All-In-1 System is a pneumatic compression system designed to increase blood flow in non-ambulatory or resting patients.

The veins in the calf and foot provide a natural pump that, when compressed, push blood back toward the heart. PlexiPulse® All-In-1 System helps this natural calf and foot pump circulate blood throughout the patient's system when the normal circulatory process is disabled from surgery, injury, or disease.

The PlexiPulse® Pump is connected by tubing to individual inflatable foot wraps and calf wraps that can be operated together or independently. Each foot and calf wrap is designed to provide a comfortable fit around the calf and foot with an air bladder that squeezes "all around" the soleus sinus in the calf and the venous plexus in the arch, plus collateral veins in both calf and foot. The PlexiPulse® Pump can accommodate all the following PlexiPulse® wraps with just one Pump, and the patient can use different types of wraps on the left and right side at the same time.

- **Foot Wrap** - Provides excellent proximal Deep Vein Thrombosis (DVT) prophylaxis by squeezing "all around" the venous plexus in the arch and collateral veins of the foot.
- **Calf Wrap** - May help provide good distal and proximal DVT prophylaxis.
- **Combo Wrap** - A combination of both therapies may provide the most aggressive DVT prophylaxis.

CONTRAINDICATIONS

Patient conditions for which the PlexiPulse® is contraindicated include:

- Presumptive evidence of congestive heart failure.
- Suspected pre-existing Deep Vein Thrombosis.

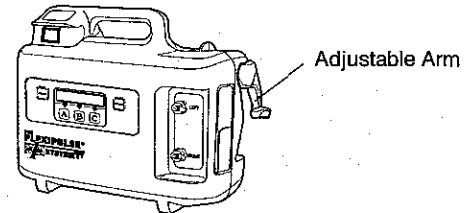
SAFETY TIPS

- **Do Not Walk In Foot Wrap** - Foot wraps must always be removed before walking.
- **Regular Skin Assessments** - A stockinette or sock worn under wrap may assist in the prevention of skin breakdown, and is recommended for high risk patients. Frequently monitor skin condition in wrap area, particularly on top of foot and behind ankles.
- **Fluids** - Avoid spilling fluids on pump controls. If spills do occur, clean fluid from pump wearing rubber gloves to avoid shock. Once fluid is removed, check operation of components in area of spill.

NOTE: *Fluids remaining on controls can cause corrosion, which may cause the electronic components to fail or operate erratically, possibly producing potential hazards for patient and staff.*

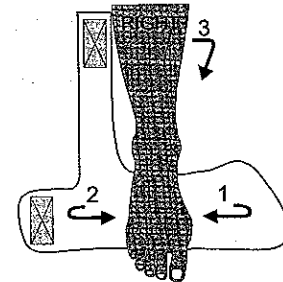
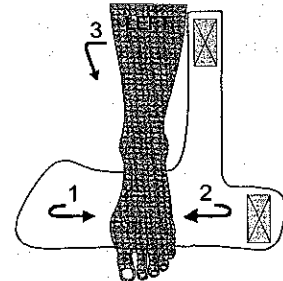
It is recommended that all sections of this manual be reviewed prior to PlexiPulse® All-In-1 System use. **Carefully read the Safety Tips sections in the Introduction chapter prior to patient placement with the PlexiPulse® All-In-1 System.**

1. Hang the PlexiPulse® All-In-1 System on footboard of bed using adjustable arms on each side of PlexiPulse® Pump Case.



2. Apply wrap(s) as shown at right:

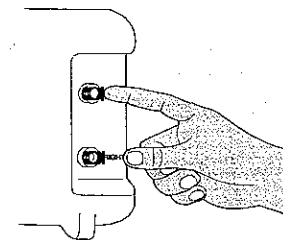
- A. Position foot over Wrap and fold first flap over top of foot.
- B. Fold second flap (with hook-and-loop patch) comfortably over top of first flap and secure.
- C. Wrap back strip comfortably over heel and secure.



3. Connect tubing from wrap(s) to Pump Case:

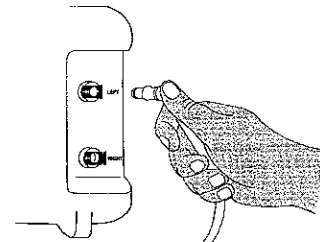
- A. Press valve tab to ensure valve is prepared for tube insertion as shown at right.

NOTE: Valve will click into position if it is not in correct position to receive tubing.



- B. Insert tubing connector into appropriate valve as shown at right.

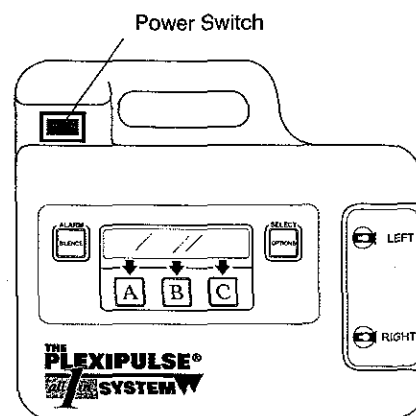
NOTE: Valve will click when tubing is locked into place.



4. Plug PlexiPulse® Power Cord into a 115V AC 15 amp. outlet.

NOTE: Power to the outlet must **NOT** be controlled by a wall switch.

5. Press Power Switch on front face of Pump Case to turn on the PlexiPulse® Pump.



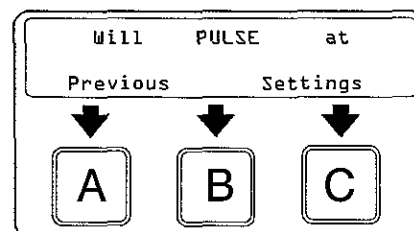
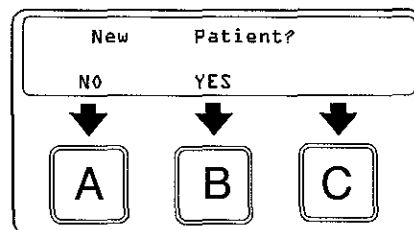
When display shown at right appears, **either**:

- A. Press "A" under NO, if the patient is not a new patient.

- 1) The Pump will begin pulsating at previous settings held in memory since Pump was last turned off.

- 2) Display shown at right will appear temporarily and then automatically return to the Home Display.

- a) Press OPTIONS Button to begin adjustments as described in the **Compression Adjustment** section of the **Operating Instructions** chapter of this manual.



OR:

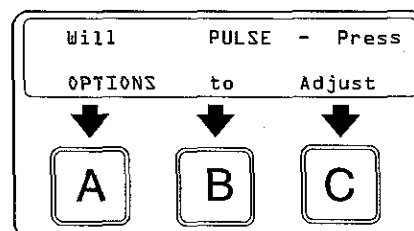
- B. Press "B" under YES, if the patient is a new patient or if standard settings are desired.

- 1) The Pump will begin pulsating at the standard settings and can be adjusted and customized for the individual patient.

- 2) Display at right will appear.

- a) Press OPTIONS to begin adjustments described in the **Operating Instructions** chapter of this manual.

NOTE: If OPTIONS Button is not pressed, Pump will automatically compress at the "standard settings" (Both, Cycle 20 sec., Hold 2 sec., and Pressure Settings 3) and then return to Home Display.

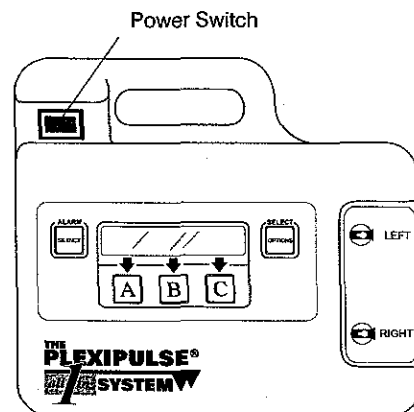


NOTE: If neither "A" nor "B" are pressed after 25 seconds, the Pump will automatically begin compression at previous settings and return to the Home Display.

It is recommended that all sections of this manual be reviewed prior to PlexiPulse® All-In-1 System use. **Carefully read the Safety Tips sections in the Introduction chapter prior to performing nursing care for a patient using the PlexiPulse® All-In-1 System.**

CPR

1. Level Bed.
2. Press Power Switch on front of PlexiPulse® Pump to turn Pump off.
3. Begin CPR.



CAREGIVER CONVENIENCE

The PlexiPulse® Pump contains the following features to facilitate patient care.

- Easy on/off disposable wrap(s).
- Preset compression therapy.
- Portable and light-weight.

SKIN CARE

- Remove excess moisture and keep skin dry and clean.
- Watch for changes in skin condition and provide appropriate care.
- Follow the physician's recommended protocol for this product and all associated therapies.
- Notify physician of any skin changes.
- Change wound dressings as prescribed by physician.

The following are KCI USA - recommended routine cleaning and infection control procedures when the PlexiPulse[®] All-In-1 System is in use. Refer to the **Infection Control Procedures** section of the **Preparation for Use** chapter in the **Maintenance Manual** for recommended infection control procedures.

CLEANING PROCEDURES FOR THE PLEXIPULSE[®] ALL-IN-1 PUMP

1. Press Power Switch to turn Pump off.
2. Unplug PlexiPulse[®] Pump Power Cord from power outlet.
3. Wipe Pump clean using a soft cloth and any type of cleaner suitable for hospital use to wipe Pump clean.

WARNING

Avoid spilling fluids on any part of the Pump. Fluids remaining on electronic controls can cause corrosion, which may cause electronic components to fail or operate erratically, possibly producing hazards to patient and Caregiver.

This chapter contains instructions for setting and adjusting functions of the PlexiPulse® All-In-1 Pump. It is recommended that all sections of this manual be reviewed prior to PlexiPulse® All-In-1 System use. **Carefully read the Safety Tips sections in the Introduction chapter prior to operating the PlexiPulse® All-In-1 Pump.**

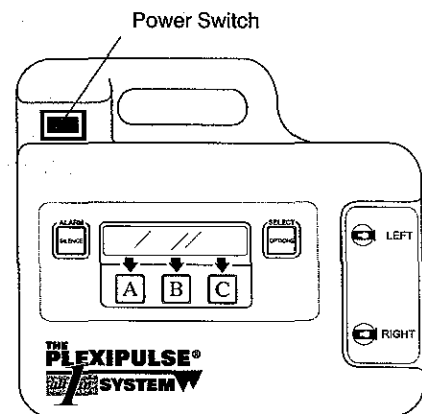
CONTROL PANEL FUNCTIONS

Power-On Procedure

1. Plug Pump Power Cord into a 115V AC, 15 Amp outlet.

NOTE: Power outlet must not be controlled by a wall switch.

2. Press Power Switch on front face of Pump case to activate the PlexiPulse® All-In-1 System.

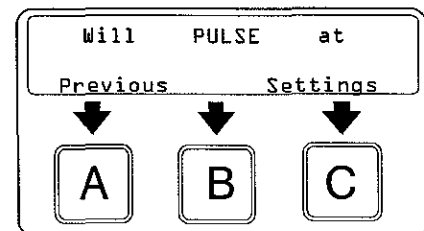
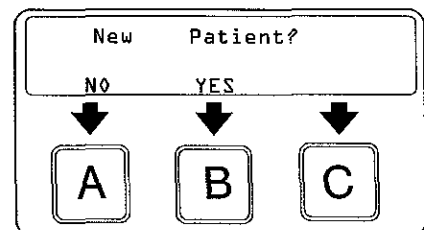


When display shown at right appears, **either:**

- A. Press "A" under NO if the patient is not a new patient.

- 1) Pump will begin compression at settings held in memory since the Pump was last turned off.

- 2) Display shown at right will appear temporarily and then automatically return to Home Display.



OR:

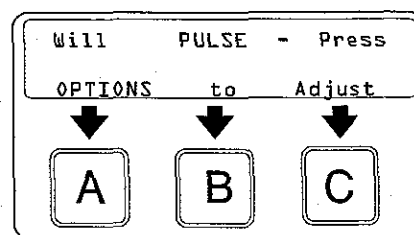
- B. Press "B" under YES if patient is a new patient or if standard settings are desired.

- 1) The Pump will begin pulsating at the standard settings and can be adjusted and customized for the individual patient.

2) Display at right will appear.

- a) Press OPTIONS Button to begin adjustments described in the **Compression Adjustment** section in this chapter of this manual.

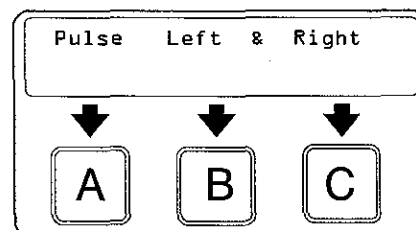
NOTE: If the OPTIONS Button is not pressed, Pump will automatically compress at the "standard settings" (Both, Cycle 20 sec., Hold 2 sec., and Pressure Settings 3) and then return to Home Display.



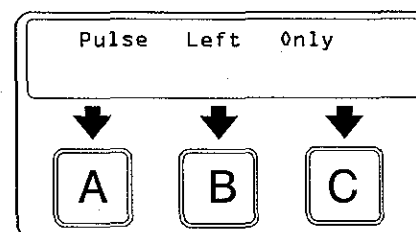
NOTE: If neither "A" nor "B" are pressed after 25 seconds, the Pump will automatically begin compression at previous settings and return to the Home Display.

3. After previous compressions settings have been accepted, or have been adjusted using OPTIONS, one of the Home Displays shown at the right will appear and indicate the following:

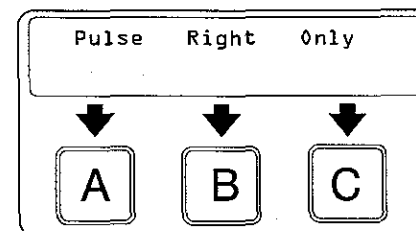
- A. Both left and right sides are selected to alternately receive compression therapy. The side that is currently compressing will flash.



- B. Compression is on and only the left side is selected to receive compression therapy.



- C. Compression is on and only the right side is selected to receive compression therapy.



Compression Therapy

When the Pump is turned on or after the alarm is silenced, compression always begins at a lower pressure than that selected and "ramps up" to the selected pressure over a period of approximately 2 to 3 minutes. Ramping-up helps maximize patient comfort.

As compression is provided, the Pump monitors inflation pressures for each side. With pressure feedback, the Pump will automatically adjust its output to provide the selected pressure and compensate for a wrap that is too loose or too tight.

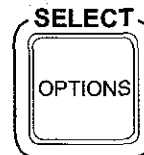
If pressure oddities (e.g., tubing disconnected at the wrap, kinked hose, damaged wrap, or an open wrap) are detected for 5 consecutive cycles, compression will continue while an audible alarm sounds.

The alarm can be temporarily silenced by pressing either "A", "B", "C", or "ALARM SILENCE". The Pump will ramp up, perform approximately 5 cycles, and then alarm again if the abnormality has not been corrected. Refer to **Alarm Procedure** section in this chapter for more information.

Additionally, if a Pump malfunctions, an audible alarm will sound and the Pump will **stop compressing**. If turning the Pump off, then on, and reconnecting the tubing does not resolve the abnormality, contact your local sales representative or KCI Customer Service at 1-888-ASK-4KCI (1-888-275-4524).

Compression Adjustment Procedure (SELECT OPTIONS)

When **prescribed**, compression settings may be adjusted by repeatedly pressing SELECT OPTIONS illustrated at right. Compression adjustment options will be sequentially displayed in the following order:



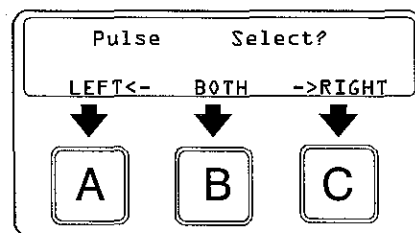
- Pulse Select.
- Cycle Time.
- Hold Time.
- Left Pressure.
- Right Pressure.
- View Hour Meter.

If no option selection is made, within approximately one minute, all SELECT OPTION displays will automatically return to Home Display.

COMPRESSION LOCATION ("PULSE SELECT?") ADJUSTMENT

Use the "Pulse Select?" option to select the side(s) to receive compression therapy.

1. Press SELECT OPTIONS until "Pulse Select?" is displayed as shown at right.
2. Press "A", "B", or "C" to direct compression to the desired side(s):
 - A. Pressing "A" under LEFT directs compression to left side only.
 - B. Pressing "B" under BOTH directs compression to both sides on an alternating cycle.
 - C. Pressing "C" under RIGHT directs compression to right side only.



NOTE: The compression option selected ("LEFT," "BOTH" or "RIGHT") will flash.

3. Press button under flashing selection to return to Home Display.

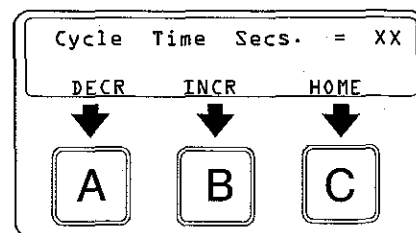
CYCLE TIME ADJUSTMENT

Use the "Cycle Time Secs. = XX" option to view and adjust approximate time required for wrap(s) to inflate, hold pressure, and deflate.

NOTE: Cycle time can be adjusted from 20 to 60 seconds in 10-second increments.

Example: If both sides are selected for compression and the cycle time is 30 seconds, **each** side will alternately, inflate, hold, and deflate over a period of approximately 30 seconds. If only one side is selected for compression and the cycle time is 30 seconds, the wrap on that side will inflate, hold, and deflate approximately every 30 seconds.

1. Press SELECT OPTIONS until "Cycle Time Secs. = XX" is displayed as shown at right.
2. Press "A" under DECR to shorten cycle time.
3. Press "B" under INCR to lengthen cycle time.
4. When the desired cycle time is shown:
 - A. Press "C" under HOME to return to Home Display, **or**
 - B. Press SELECT OPTIONS to display the next option.

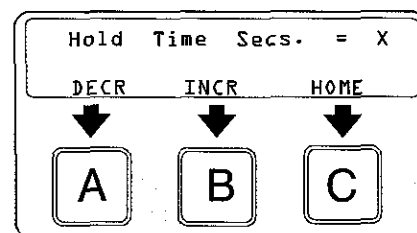


HOLD TIME ADJUSTMENT

Use the "Hold Time Secs. = X" option to view and adjust the time that air is held in the wrap between inflation and deflation during a cycle.

Hold Time can be adjusted from 1 to 5 seconds in 1-second increments. Hold Time is the same for each side, regardless of whether one or both sides are selected.

1. Press SELECT OPTIONS until "Hold Time Secs. = X" is displayed as shown at right.
2. Press "A" under DECR to shorten Hold Time.
3. Press "B" under INCR to lengthen Hold Time.
4. When the desired Hold Time is shown:
 - A. Press "C" under HOME to return to Home Display, **or**
 - B. Press SELECT OPTIONS to display the next option.



INFLATION PRESSURE ADJUSTMENT

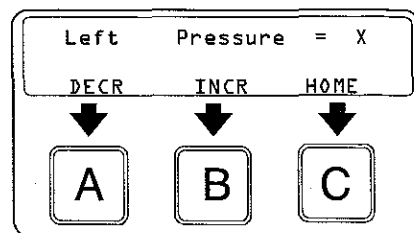
Left Wrap Pressure Adjustment

Use the "Left Pressure = X" option to view and adjust inflation pressure of left wrap during each cycle.

Pressure settings can be adjusted from a value of 1 to 5 in increments of 1 unit. The following chart shows what each wrap pressure setting corresponds to in mm Hg.

PRESSURE SETTING	Pressure mm Hg (+15/-20)
1	140
2	150
3	160
4	170
5	180

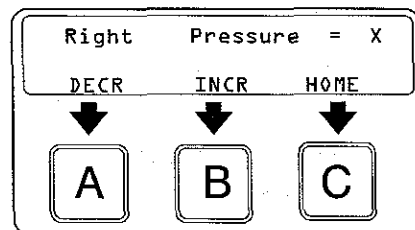
1. Press SELECT OPTIONS until "Left Pressure = X" is displayed as shown at right.
2. Press "A" under DECR to reduce pressure.
3. Press "B" under INCR to increase pressure.
4. When desired left pressure setting is displayed:
 - A. Press "C" under HOME to return to Home Display, or
 - B. Press SELECT OPTIONS to display the next option.



Right Wrap Pressure Adjustment

Use the "Right Pressure = X" option to view and adjust inflation pressure of right wrap during each cycle. The display shown at the right will appear.

NOTE: Pressure adjustment for the right-wrap is the same as the pressure adjustment for the left-wrap described in steps 1 through 4 above.

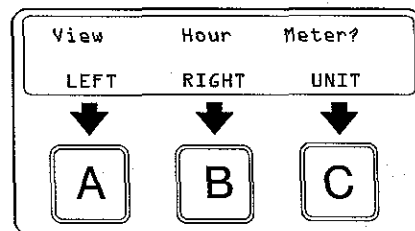


THERAPY HOURS METER

Use the "View Hour Meter?" option to view the number of therapy hours on Pump and hours to left and right sides.

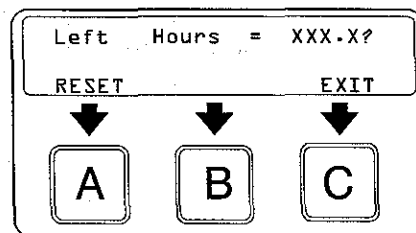
NOTE: Left, Right, and Pump hours are shown to the nearest 1/10 hour.

1. Press SELECT OPTIONS until "View Hour Meter?" is displayed as shown at right.



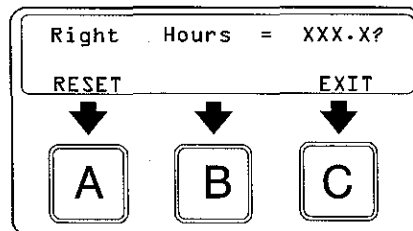
2. Press "A" under LEFT to view therapy hours provided to left side. Display shown at right will appear.

- A. Press "A" again to reset number of hours for the left side to 0.
 - B. Press "C" under EXIT to return to "View Hour Meter?" display.



3. With "View Hour Meter?" showing, press "B" under RIGHT to view therapy hours provided to right side. Display shown at right will appear.

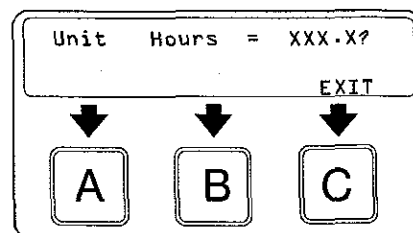
- A. Press "A" again to reset number of hours for right side to 0.
 - B. Press "C" under EXIT to return to "View Hour Meter?" display.



4. With "View Hour Meter?" showing, press "C" under Unit Hours to view total hours of Pump operation. Display shown at right will appear.

NOTE: Unit Hours cannot be reset, but they may be useful to your Biomedical department.

- A. Press "C" under EXIT to return to "View Hour Meter?" display.
- B. Press SELECT OPTIONS to begin sequence of options again.



ALARM PROCEDURE

An alarm will sound and the Pump will continue pulsing if one of the following conditions occurs for 5 consecutive cycles.

- Disconnected external wrap tube.

NOTE: A disconnected wrap tube will cause pump to malfunction. After connecting tubing, turn pump off and then back on to reset malfunction.

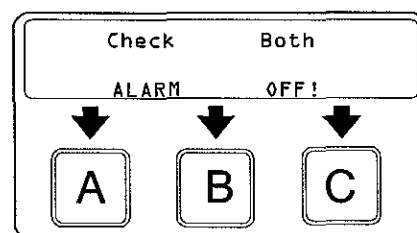
- Open or loose wrap.
- Damaged wrap.
- Kinked hose.

NOTE: The alarm can be temporarily silenced by pressing "A", "B", "C", or "Alarm Silence". The Pump will ramp-up, perform approximately five cycles, and then alarm again if abnormality has not been corrected.

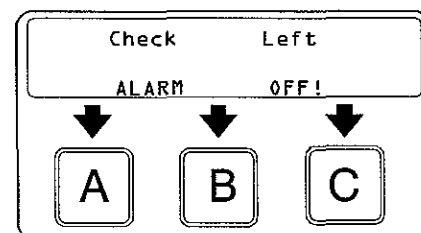
A visual inspection of the Plexipulse® System will usually indicate which of the above conditions exists, and the appropriate steps can be taken to correct the situations.

One of the following Alarm displays will appear to indicate where the abnormality can be found.

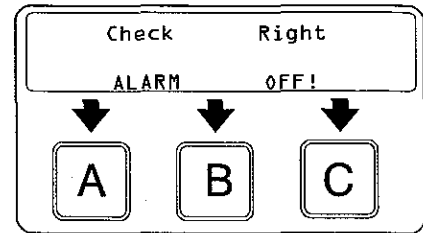
1. If an abnormality is detected on both sides, press "A", "B", "C", or "Alarm Silence" to stop the alarm.



2. If an abnormality is detected on the left side, press "A", "B", "C", or "Alarm Silence" to stop the alarm.

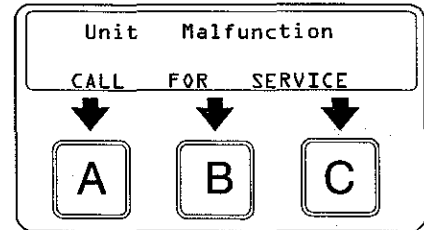


3. If an abnormality is detected on the right side, press "A", "B", "C", or "Alarm Silence" to stop the alarm.



If an internal malfunction is detected, or if external tubing is disconnected at the Pump, an alarm will sound and the Pump will **immediately** (or within 3 cycles during "ramp-up") stop pulsing.

1. If Pump detects an internal abnormality, turn Pump off, then on, and reconnect external tubing.
2. If step 1 does not resolve abnormality, call your local sales representative or KCI Customer Service 1-888-ASK-4KCI (1-888-275-4524).

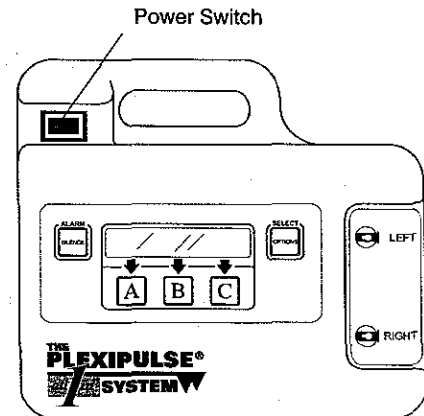


POWER-OFF PROCEDURE

1. Press Power Switch to turn off the PlexiPulse® System.
2. Unplug Pump Power Cord from outlet.

NOTE: Compression settings are retained in memory when Pump is turned off. During Power-On Procedure, the operator is given an option to reinstate previous compression settings or go to standard settings for a new patient.

3. Remove and discard wraps and tubing, when therapy for the patient is complete.



Preparing the PlexiPulse® All-In-1 System for use entails inspecting for damaged or unserviceable components as well as performing procedures in **Set-Up Procedure**, **Check-out Procedure**, and **Infection Control Procedure** sections.

If there are questions about proper assembly and disassembly of the PlexiPulse® All-In-1 System, contact your local KCI USA representative or KCI Customer Service 1-888-ASK-4KCI (1-888-275-4524). It is recommended that qualified, trained personnel perform the procedures outlined in this chapter. Please follow all applicable warnings and universal precautions.

SET-UP PROCEDURE

The PlexiPulse® Pump is shipped from the manufacturer fully assembled and ready to put into service with the addition of articles listed in step 3. Before putting Pump into service, the following steps are necessary.

1. Open carton.

NOTE: Do not use sharp instruments to open carton to avoid damaging Pump Case.

2. Inspect Pump Case for visible damage occurring during transport and contact carrier and KCI Customer Service 1-888-ASK-4KCI (1-888-275-4524) immediately if damage is observed.
3. Gather the following articles from inventory:
 - One Quick Reference Guide.
 - One set of test Wraps.
4. Attach Quick Reference Guide to Pump handle with reusable Tie-wrap attached to handle.

CHECK-OUT PROCEDURE

Procedures to verify proper operation of the PlexiPulse® Pump are provided in the following steps. Refer to **Operating Instructions** chapter in the **Operations Manual** if necessary. If results of this procedure are not as specified, refer to the **Troubleshooting** chapter.

Testing Pump Functions

1. Plug Pump Power Cord into a 115V AC, 15 amp. outlet.
2. Connect tubes from wraps to pump.
3. Install wraps onto feet.

NOTE: Failing to place test wraps on both feet will cause the pump to malfunction.

4. Press Power Switch and verify the following:
 - A. Light in switch illuminates.
 - B. Pump is activated.
 - C. "New Patient?" display appears on control panel.

5. Press "B" for YES in response to display prompt and observe the following:

- A. Pump automatically begins compression at standard settings.

NOTE: Wraps will inflate/deflate.

- B. As SELECT OPTIONS is pressed to sequence through compression options, the standard settings will be displayed (**Both, Cycle 20 sec., Hold 2 sec., Pressure Settings 3**).

6. Press SELECT OPTIONS to sequence and customize available Compression Therapy options following procedures in **Compression Adjustment Procedures** section of the **Operating Instructions** chapter. Results of the procedures must correspond with those outlined.

NOTE: An electrical leakage test has already been performed on the Pump. Leakage is below 100 microamps. All additional required tests to meet UL544 standards have also been performed before shipment.

Testing Wrap Pressures

1. Remove hose from connector at wrap.
2. Connect tubing for test wraps to pump.
3. Install test wraps on both feet.

NOTE: Failing to place test wraps on both feet will cause the pump to malfunction.

4. Insert 5/32 inch Tee fitting into hose and use 1 to 2 inches of the same size tubing to connect the other side of Tee fitting to connector.
5. Connect bottom of Tee fitting to a 0 to 300 mm Hg pressure gauge.
6. Place wrap around foot as shown in **Patient Placement** chapter.
7. Insert tube connector into tubing valve on Pump.
8. Press Power Switch to turn Pump on.
9. Press "B" under YES and allow Pump to ramp-up approximately 3 to 5 cycles (2 to 3 minutes). Gauge pressure should read 160 +15/-20 mm Hg.
10. Verify all pressure settings according to procedures in **Compression Adjustment Procedure** section of the **Operating Instructions** chapter to customize Pump. Pressure ranges for all settings are as follows:

PRESSURE SETTING	Pressure mm Hg (+15/-20)
1	140
2	150
3	160
4	170
5	180

INFECTION CONTROL PROCEDURE

Refer to the Infection Control Policy in the **Service Quality Manual** for **Infection Control Procedures**. Please contact your KCI Customer Service Department 1-888-ASK-4KCI (1-888-275-4524) to obtain a **Service Quality Manual**.

Follow all hospital or institutional infection control protocols when handling contaminated equipment.

Decontamination Procedures at Authorized Service Facility

PROTECTIVE CLOTHING

When cleaning and disinfecting Pumps at the hospital or Service Center, it is recommended that personnel dress as follows:

1. Wear heavy rubber or disposable gloves and an impervious apron or gown to prevent contact with cleaning solutions and/or contaminated equipment.
2. Wear eye protection to prevent splashing cleaning materials into eyes.

WARNING

Germicide concentrates can cause serious corneal damage if allowed to contact the eyes. If contact does occur, flush immediately with generous amounts of flowing fresh water. Should irritation persist, consult a physician.

Spray bottles are not to be used. Improperly spraying solutions can lead to inhalation of toxic fumes.

Avoid spilling fluids on any part of the control panel or electronics. Fluids remaining on controls can cause corrosion, which may cause the electronic components to fail or operate erratically, possibly producing potential hazards for patients and staff.

IMPORTANT

Germicidal concentrates can damage the touch pad control switches and power switch. Do not allow such agents to come in contact with these areas. It is recommended that a cloth moistened only with denatured alcohol be used to clean and disinfect these areas.

DECONTAMINATING THE PLEXIPULSE® PUMP

The Pump Case must be cleaned after every placement.

1. Wipe all areas of the Pump Case (except touch pad and Power Switch areas) with a cloth using an EPA-registered, hospital-strength disinfectant solution. (Following all manufacturer recommendations).
2. Remove and clean all visible soiling.
3. If blood or other body fluids are present on the surface of the Pump, perform the following two-step cleaning process recommended by OSHA:
 - First, apply an EPA-registered tuberculocidal disinfectant to remove and clean all visible soiling.
 - Second, wipe down with 1:100 sodium hypochlorite solution or an EPA-registered, hospital-strength disinfectant solution.
4. Wash hands.
5. Allow Pump Case to air dry.

Troubleshooting information for the PlexiPulse® Pump is provided in the **Theory of Operation** section of this chapter. Each section provides technical information for use in identifying causes of abnormal conditions.

Information in this chapter should be used in conjunction with the **PlexiPulse® Schematic and Pneumatic System "Red Button"** and **Schematic and Pneumatic System "Green Button"** diagrams located in the **Replacement Parts Manual**, and the removal and replacement procedures provided in the **Maintenance** chapter of this manual. All internal troubleshooting should be performed only by a qualified service technician.

The following **Cautions and Warnings** should be observed during all troubleshooting procedures:



High voltage equipment to be serviced by trained, qualified personnel only. Dangerous voltages can present a significant shock or burn hazard to personnel.



Power must be switched off and Power Cord unplugged prior to any maintenance procedure.



Carefully observe and mark locations and routing of all cables and tubing removed while performing the procedure in order to properly locate connections, cables and their tie-wraps during replacement. Wiring and tubing must be reinstalled exactly as before removal to ensure unit operation.



Wear Ground Strap whenever handling Printed Circuit Boards and board components. An electrostatic discharge (ESD) may cause components to fail or operate erratically, possibly producing hazards for patient and staff.

THEORY OF OPERATION

Operational principles of the PlexiPulse® Pump are provided in the **PlexiPulse® Pump Power Distribution**, **PlexiPulse® Pump Pneumatic Distribution** and **PlexiPulse® Pump Major Circuit Board Components** sections below for use in identifying abnormal conditions.

PlexiPulse® Pump Power Distribution

“RED BUTTON PUMP” POWER DISTRIBUTION

Refer to **FIG. 7-1**.

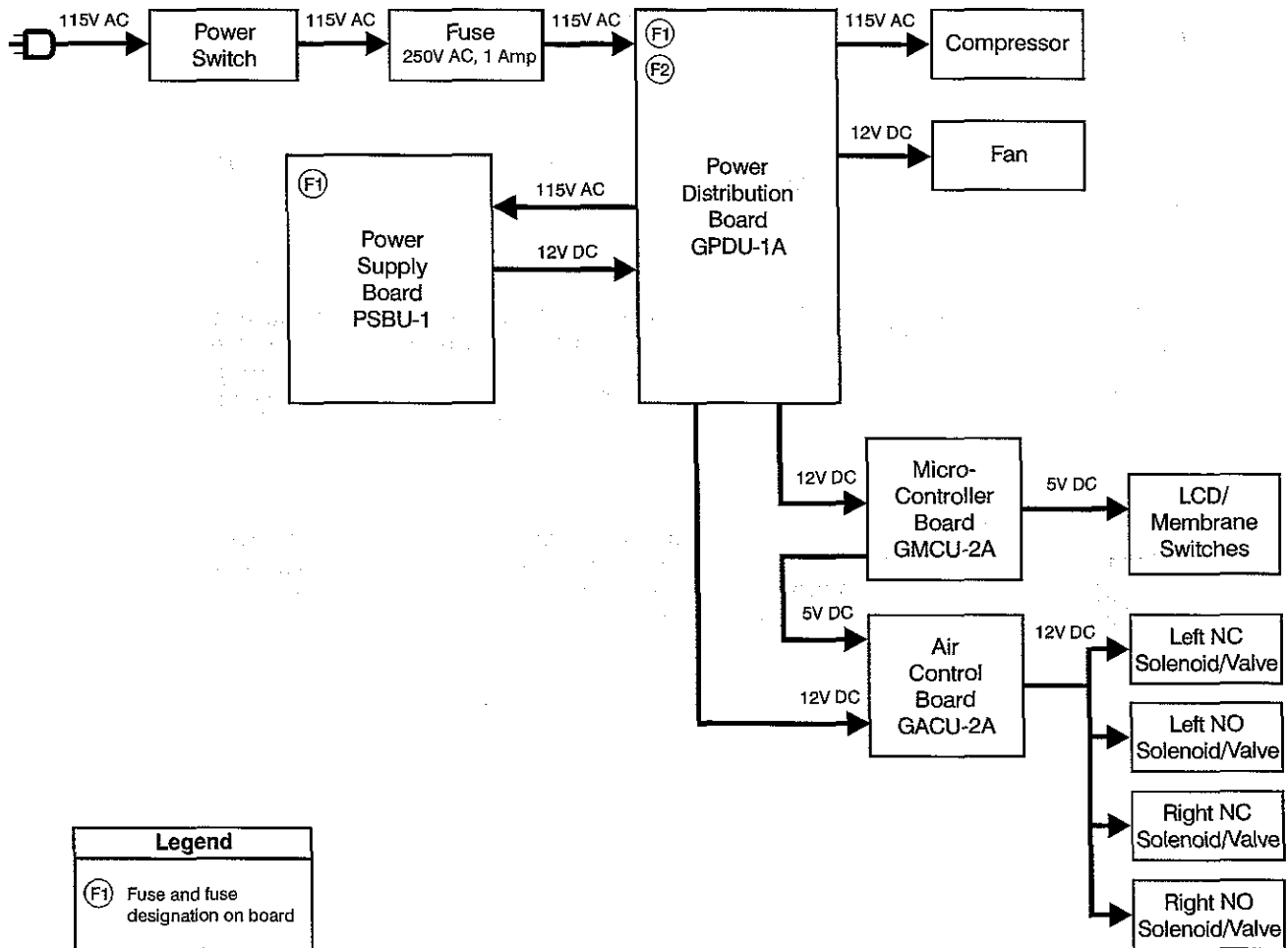


FIG. 7-1. PlexiPulse® Pump “Red Button Pump” Power Distribution

Power Switch

- Lighted pushbutton switch.
- Receives 115V AC facility power through Power Cord.
- Supplies 115V AC through in-line Fuse to Power Distribution Board GPDU-1A.

Fuse 250V AC, 1 Amp.

- Provides overcurrent protection for the Pump.

Power Distribution Board GPDU-1A

- Distributes power throughout Pump.
- Receives 115V AC when Power Switch is depressed.
- Supplies 115V AC to Compressor.
- Supplies 115V AC to Power Supply Board PSBU-1.
- Receives 12V DC from Power Supply Board PSBU-1.
- Supplies 12V DC to Fan.
- Supplies 12V DC to Micro-Controller Board GMCU-2A.
- Supplies 12V DC to Air Control Board GACU-2A.

Compressor

- Generates compressed air for Pump therapeutic functions.
- Receives 115V AC from Power Distribution Board GPDU-1A.

Fan

- Provides cooling for Pump internal components.
- Receives 12V DC from Power Distribution Board GPDU-1A.

Power Supply Board PSBU-1

- Converts 115V AC into 12V DC.
- Receives 115V AC from Power Distribution Board GPDU-1A.
- Supplies 12V DC to Power Distribution Board GPDU-1A.

Micro-Controller Board GMCU-2A

- Controls Pump functions.
- Converts 12V DC to 5V DC.
- Receives 12V DC from Power Distribution Board GPDU-1A.
- Supplies 5V DC to Membrane Panel.
- Supplies 5V DC Solenoid/Valve control signals to Air Control Board GACU-2A.

LCD and Membrane Switches

- Provides operator interface to Pump controls and prompts.
- Receives 5V DC from Micro-Controller Board GMCU-2A.

Air Control Board GACU-2A

- Provides air pressure sensing.
- Receives 12V DC from Power Distribution Board GPDU-1A.
- Receives 5V DC Solenoid/Valve control signals from Micro-Controller Board GMCU-2A.
- Supplies 12V DC to Solenoid/Valves.

Solenoid/Normally Closed (NC) and Normally Open (NO) Valves

- Receive 12V DC from Air Control Board GACU-2A to open valves.

“GREEN BUTTON PUMP” POWER DISTRIBUTION

Refer to **FIG. 7-2**.

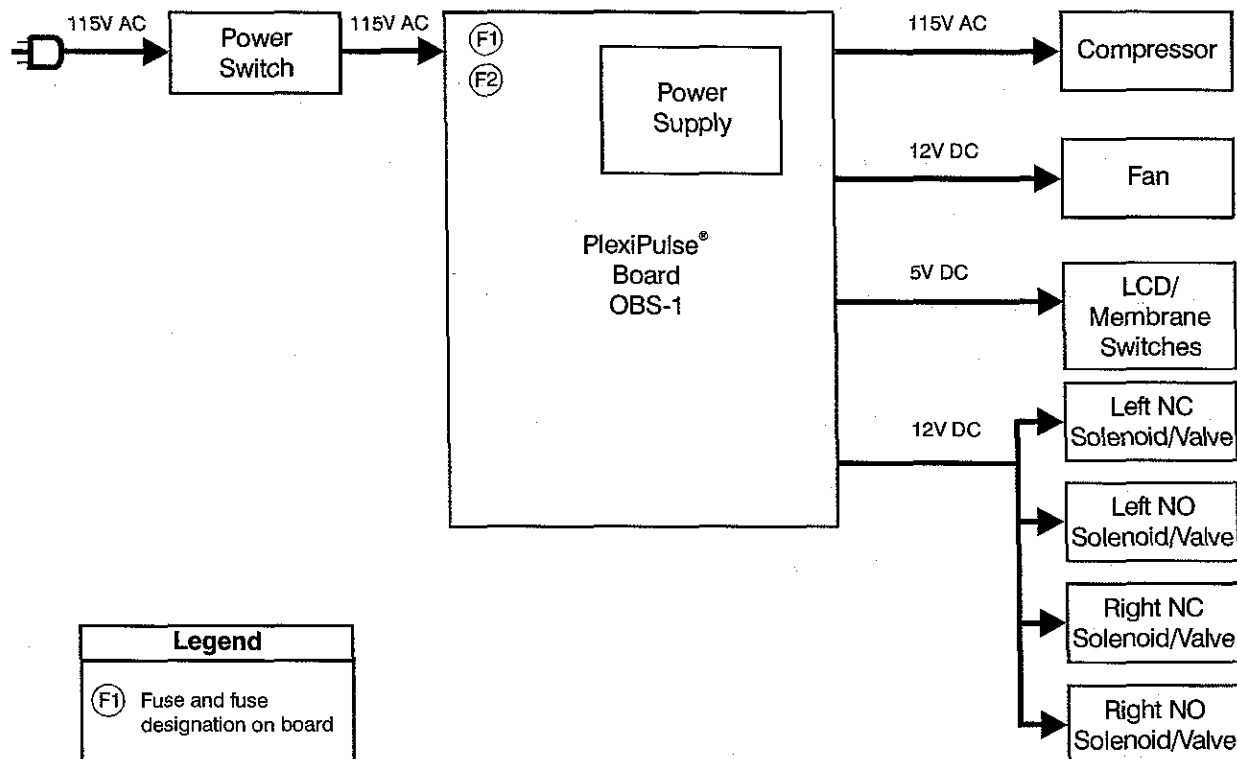


FIG. 7-2. PlexiPulse® Pump “Green Button Pump” Power Distribution

Power Switch

- Lighted pushbutton switch.

- Receives 115V AC facility power through Power Cord.
- Supplies 115V AC to PlexiPulse® Board OBS-1.

PlexiPulse® Board OBS-1

- Provides power distribution and control of Pump functions.
- Provides pressure sensing.
- Receives 115V AC from Power Switch.
- Supplies 115V AC to Compressor.
- Converts 115V AC into 12V DC and 5V DC.
- Supplies 12V DC to Fan.
- Supplies 5V DC to Membrane Panel.
- Supplies 12V DC to Solenoid/Valves.

Compressor

- Generates compressed air for Pump therapeutic functions.
- Receives 115V AC from PlexiPulse® Board OBS-1.

Fan

- Provides cooling for Pump internal components.
- Receives 12V DC from PlexiPulse® Board OBS-1.

LCD and Membrane Switches

- Provides operator interface to Pump controls and prompts.
- Receives 5V DC from PlexiPulse® Board OBS-1.

Solenoid/Normally Closed (NC) and Normally Open (NO) Valves

- Control air supply to Foot Wraps.
- Receive 12V DC from PlexiPulse® Board OBS-1 to open valves.

PlexiPulse® System Communication Distribution

“RED BUTTON PUMP” COMMUNICATION DISTRIBUTION

Refer to FIG. 7-3.

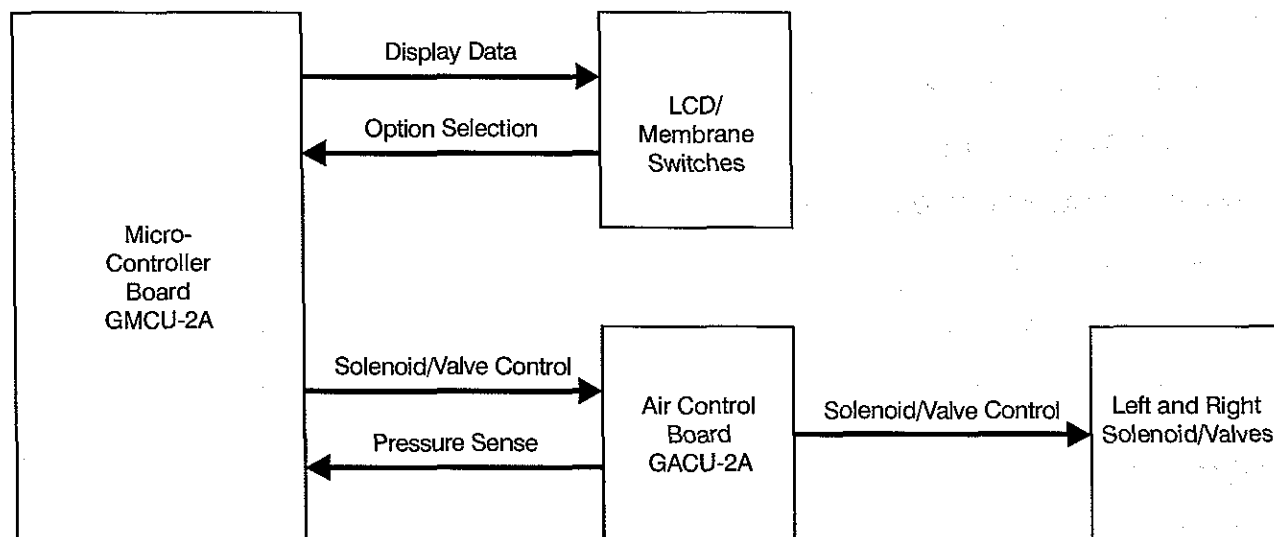


FIG. 7-3. PlexiPulse® Pump “Red Button Pump” Communication Distribution

Micro-Controller Board GMCU-2A

- Supplies data signals to Membrane Panel for display on the LCD.
- Receives operator selected option signals from pushbuttons on the Membrane Panel.
- Supplies Solenoid/Valve control signals to Air Control Board GACU-2A.
- Receives pressure readings in left and right pneumatic channels from Air Control Board GACU-2A.

LCD and Membrane Switches

- Receives data signals from Micro-Controller Board GMCU-2A for display on LCD.
- Supplies operator selected option from Membrane Switches to Micro-Controller Board GMCU-2A.

Air Control Board GACU-2A

- Receives Solenoid/Valve control signals from Micro-Controller Board GMCU-2A.
- Supplies pressure readings from left and right pneumatic channels to Micro-Controller Board GMCU-2A.
- Supplies Solenoid/Valve control voltages to Left and Right Solenoid/Valves.

Left and Right Solenoid/Valves

- Receive control voltages from Air Control Board GACU-2A.

“GREEN BUTTON PUMP” COMMUNICATION DISTRIBUTION

Refer to **FIG. 7-4**.

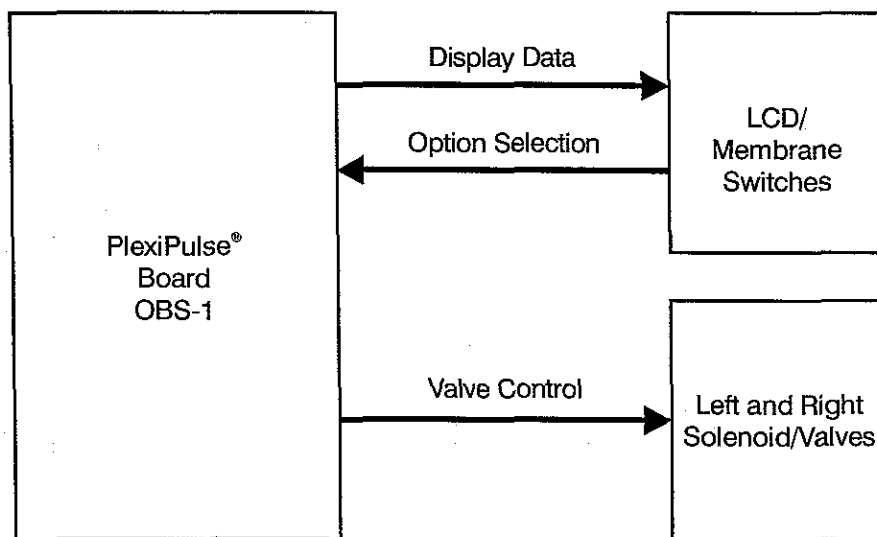


FIG. 7-4. PlexiPulse® Pump “Green Button Pump” Communication Distribution

PlexiPulse® Board OBS-1

- Supplies data signals to Membrane Panel for display on the LCD.
- Receives operator selected option signals from pushbuttons on the Graphic Membrane.
- Supplies control signals to Left and Right Solenoid/Valve.

LCD and Membrane Switches

- Receives data signals from PlexiPulse® Board OBS-1 for display on LCD.
- Supplies operator selected option to PlexiPulse® Board OBS-1.

Left and Right Solenoid/Valves

- Receives Solenoid/Valve control signals from PlexiPulse® Board OBS-1.

PlexiPulse® System Pneumatic Distribution

“RED BUTTON PUMP” PNEUMATIC DISTRIBUTION

Refer to FIG. 7-5.

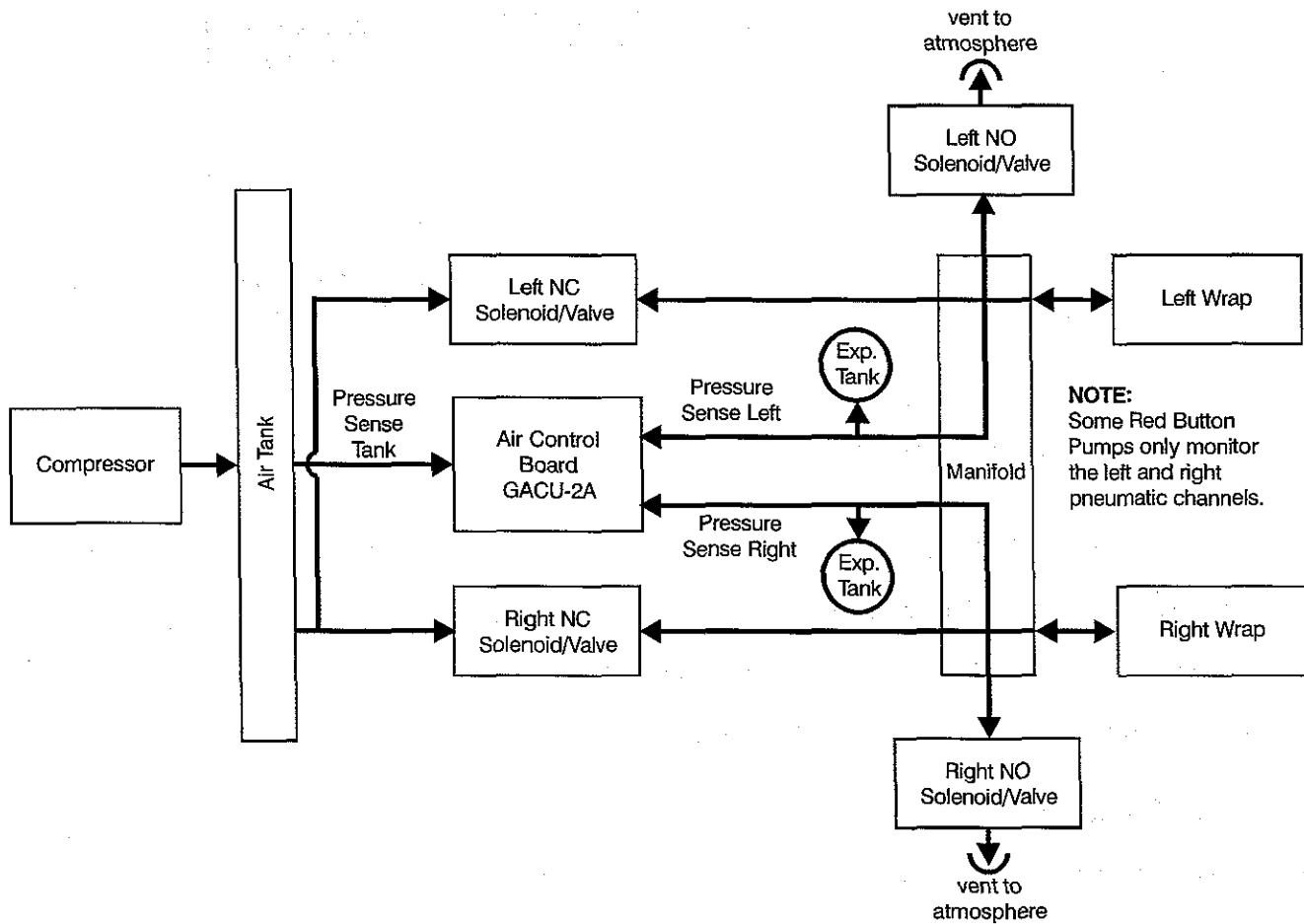


FIG. 7-5. PlexiPulse® Pump “Red Button Pump” Pneumatic Distribution

Compressor

- Generates compressed air.
- Supplies compressed air to Air Tank.

Air Tank

- Reservoir for compressed air.
- Supplies air to Left NC Solenoid/Valve and Right NC Solenoid/Valve.

Left and Right Normally Closed (NC) Solenoid/Valves

- Solenoids receive 12V DC from Air Control Board GACU-2A causing valves to open.
- Controls air flow from Air Tank to Manifold.

Manifold

- Distributes air to Left and Right NO Solenoid/Valves, Wraps, Expansion Tanks and Air Control Board GACU-2A.

Left and Right Normally Open (NO) Solenoid/Valves

- Solenoids receive 12V DC from Air Control Board GACU-2A causing valves to close.
- Open when Left and Right NC Solenoid/Valves are closed.
- When open, exhaust air from Wraps, Manifold and Expansion Tanks to atmosphere.

Left and Right Wraps

- Provide compression therapy to patient.
- Inflate as NC Solenoid/Valves are open.
- Deflate as NO Solenoid/Valves are open.

Expansion Tanks

- Smooth pressure readings sensed by Air Control Board GACU-2A.
- Fill with air when NC Solenoid/Valves are open.
- Exhaust air when NO Solenoid/Valves are open.

Air Control Board GACU-2A

- Measures air pressure in the Tank and the left and right pneumatic channels.

NOTE: Some Red Button Pumps only monitor the left and right pneumatic channels.

- Supplies 12V DC to NC Solenoid/Valves and NO Solenoid/Valves.

"GREEN BUTTON PUMP" PNEUMATIC DISTRIBUTION

Refer to FIG. 7-6.

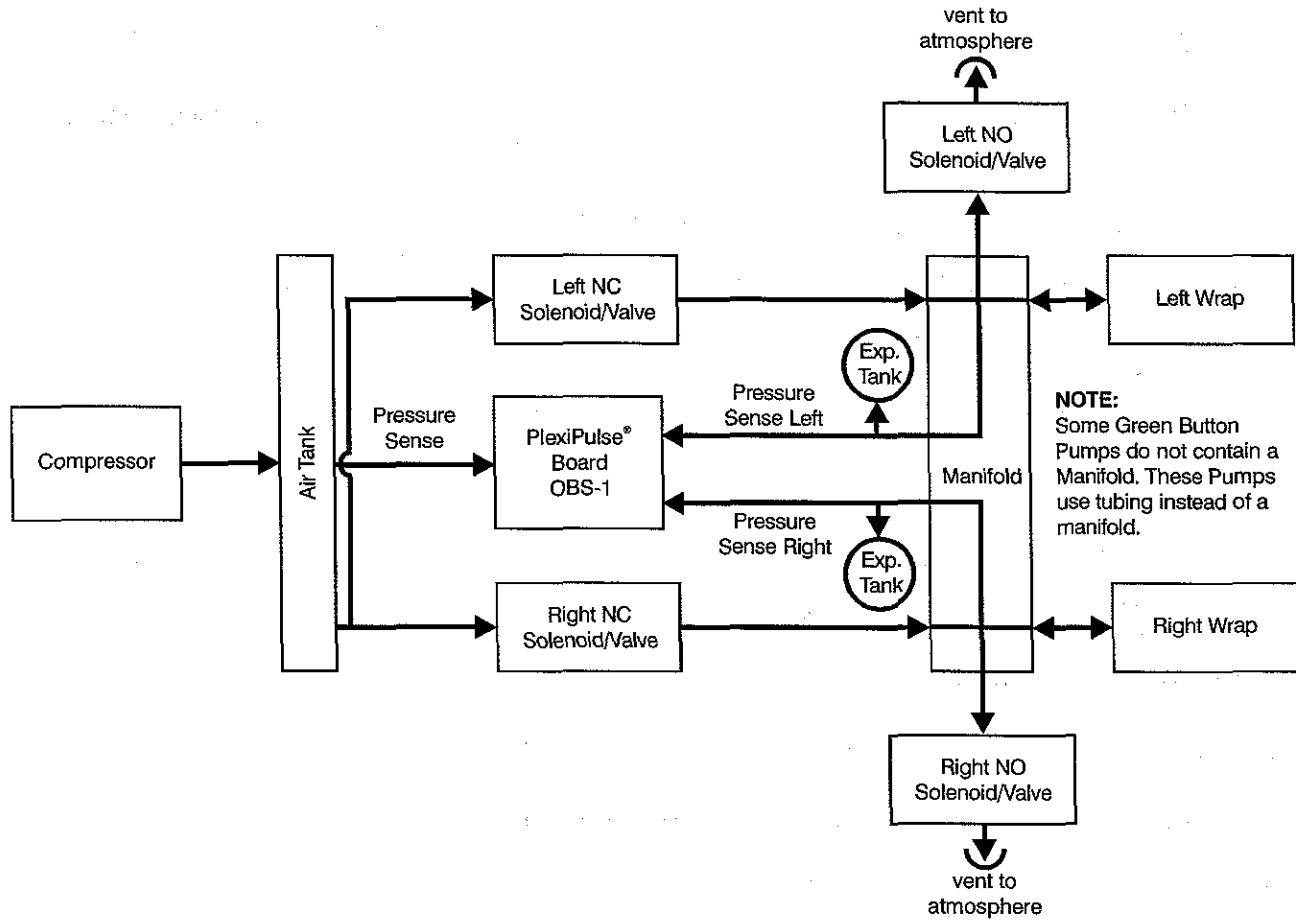


FIG. 7-6. PlexiPulse® Pump "Green Button Pump" Pneumatic Distribution

Compressor

- Generates compressed air.
- Supplies compressed air to Air Tank.

Air Tank

- Reservoir for compressed air.
- Supplies air to normally closed Left NC Solenoid/Valve, Right NC Solenoid/Valve and PlexiPulse® Board OBS-1.

Left and Right Normally Closed (NC) Solenoid/Valves

- Solenoids receive 12V DC from PlexiPulse® Board OBS-1 causing valves to open.
- Controls air flow from Air Tank to Manifold.

NOTE: Some "Green Button" Pumps do not contain a manifold. These Pumps use tubing instead of a manifold.

PlexiPulse® Board OBS-1

- Measures air pressure in Air Tank and left and right pneumatic channels.
- Supplies 12V DC to NC Solenoid/Valves and NO Solenoid/Valves.
- Provides audible alarm when pressure readings are out of range.

Manifold

NOTE: Some "Green Button" Pumps do not contain a manifold. These Pumps use tubing instead of a manifold.

- Distributes air to Left and Right NO Solenoid/Valves, Wraps and Expansion Tanks.

Left and Right Normally Open (NO) Solenoid/Valves

- Solenoids receive 12V DC from PlexiPulse® Board OBS-1 causing valves to open.
- Open when Left and Right NC Solenoid/Valves are closed.
- When open, exhaust air from Wraps, Manifold and Expansion Tanks to atmosphere.

NOTE: Some "Green Button" Pumps do not contain a manifold. These Pumps use tubing instead of a manifold.

Left and Right Wraps

- Provide compression therapy to patient.
- Inflate when NC Solenoid/Valves are open.
- Deflate when NO Solenoid/Valves are open.

Expansion Tanks

- Smooth pressure readings sensed by PlexiPulse® Board OBS-1.
- Fill with air when NC Solenoid/Valves are open.
- Exhaust air when NO Solenoid/Valves are open.

PlexiPulse® Pump Major Circuit Board

“RED BUTTON PUMP” MAJOR CIRCUIT BOARDS

Power Distribution Board GPDU-1A

The Power Distribution Board GPDU-1A receives 115V AC when the Power Switch is pressed to On. It distributes 115V AC and 12V DC throughout the Pump. Refer to **FIG. 7-7**.

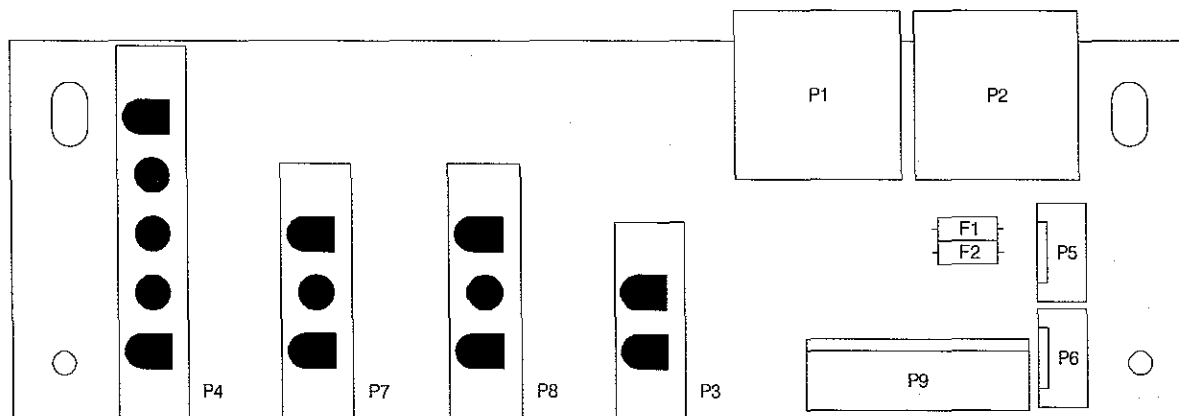


FIG. 7-7. Power Distribution Board GPDU-1A

- F1 not used.
- F2 is a non-replacable fuse that provides overcurrent protection of 12V DC supplied to Micro-Controller Board GMCU-2A.
 - Test between right side of F2 and ground and verify 12V DC is present.
 - Test between left side of F2 and ground and verify 12V DC is present.
- P1 not used.
- P2 supplies 12V DC to Micro-Controller Board GMCU-2A.
 - From top of P2 connector, test between pin 2 and pin 7 for 12V DC.

NOTE: To identify pin numbers, position pump so that the Power Distribution Board GPDU-1A is in the same relative position as shown above. From top of P2 connector start counting pin numbers from the right.

- P3 not used.
- P4 supplies 115V AC to Power Supply Board PSBU-1.
 - Test P4 between pins 1 and 2 for 115V AC.
- P5 supplies 12V DC to Air Control Board GACU-2A.
 - Test P5 between pins 1 and 2 for 12V DC.
- P6 supplies 12V DC to Fan.

- Test P5 between pins 1 and 2 for 12V DC.
- P7 receives 115V AC when Power Switch is pressed to On.
 - Test plug connected to P7 between pins 1 and 2 for 115V AC.
 - Ensure Fuse between plug and Power Switch is not blown.
 - Test Power Switch by replacing it with known good switch.
- P8 supplies 115V AC to Compressor.
 - Test P8 between pins 1 and 2 for 115V AC.
- P9 receives 12V DC from Power Supply Board PSBU-1.
 - Test plug connected to P9 between pins 3 and 4 for 12V DC.

NOTE: Brown strip on side of ribbon cable identifies pin 1 on plug.

Power Supply Board PSBU-1

The Power Supply Board receives 115V AC and converts it to 12V DC. It supplies 12V DC to the Power Distribution Board GPDU-1A for distribution throughout the Pump. Refer to **FIG. 7-8**.

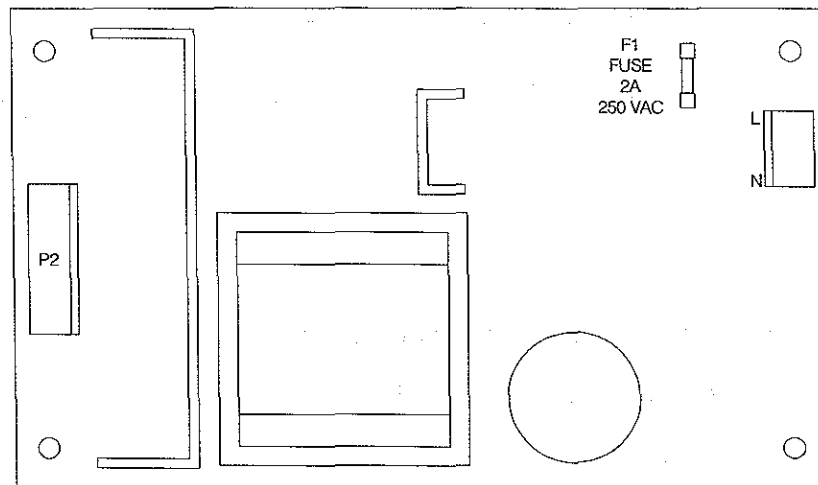


FIG. 7-8. Power Supply Board PSBU-1

- L and N receives 115V AC line voltage and neutral from Power Distribution Board GPDU-1A.
 - Test plug connected to L and N between pins 1 and 2 for 115V AC.
- F1 is a non-removable 250V AC, 2 amp fuse which provides overcurrent protection for 115V AC circuit.
 - Test between top of F1 and ground and verify 115V AC is present.
 - Test between bottom of F1 and ground and verify 115V AC is present.
- P2 supplies 12V DC to Power Distribution Board GPDU-1A.
 - Test P2 between pins 3 and 4 for 12V DC.

Micro-Controller Board GMCU-2A

The Micro-Controller Board GMCU-2A contains software that controls Pump functions. It response to operator select options from the Membrane Panel and sends messages to the Membrane Panel for displays. The Micro-Controller also receives pressure data from the Air Control Board GACU-2A and sends out control voltages to control the Solenoid/Valve. Refer to **FIG. 7-9**.

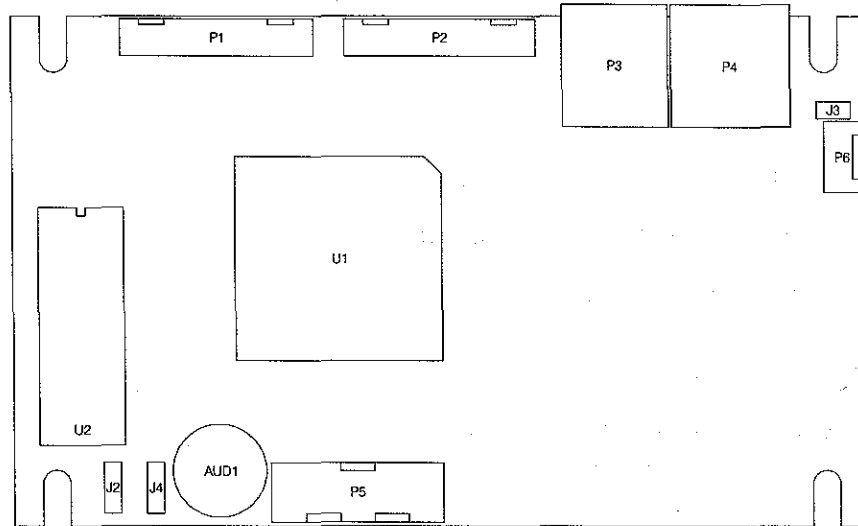


FIG. 7-9. Micro-Controller Board GMCU-2A

- AUD1 is an audible alarm that sounds when Wraps are not properly connected or Pump malfunctions.
- J2 not used.
- J3 not used.
- J4 not used.
- P1 supplies 5V DC control voltages to Air Control Board GACU-2A to open/close Solenoid/Valves.
 - Test suspect Micro-Controller Board GMCU-2A by replacing it with known good board.
- P2 receives operator selected options signals from Membrane Panel.
 - Test suspect Membrane Panel by replacing Graphic Switch Panel with known good panel.
 - Test suspect Micro-Controller Board GMCU-2A by replacing it with known good board.
- P3 receives pressure signals from Air Control Board GACU-2A.
 - Test suspect Air Control Board GACU-2A by replacing it with known good board.
 - Test suspect Micro-Controller Board GMCU-2A by replacing it with known good board.
- P4 receives 12V DC from the Power Distribution Board GPDU-1A.
 - Test P3 between pin 2 and pin 7 for 12V DC.

NOTE: To identify pin numbers, position pump so that the Power Distribution Board GPDU-1A is in the same relative position as shown above. From top of P3 connector start counting pin numbers from the right.

- P5 supplies messages to Membrane Panel for display on LCD.
 - Test suspect Micro-Controller Board GMCU-2A by replacing it with known good board.
 - Test suspect Membrane Panel by replacing LCD with known good panel.
- U1 is the microprocessor that controls all Pump functions.
- U2 is the EPROM that contains Pump software.

Air Control Board GACU-2A

The Air Control Board GACU-2A contains pressure transducers that measure the air pressure in the left and right pneumatic channels. It supplies the pressure reading to the Micro-Controller Board GMCU-2A. This board also routes control voltage signals from the Micro-Controller Board GMCU-2A to the Solenoid/Valves to control when the valves open and close. Refer to **FIG. 7-10**.

NOTE: Some Red Button Pumps contain only two Pressure Transducers (PX2 and PX4). PX2 monitors the left pneumatic channel and PX4 monitors the right channel.

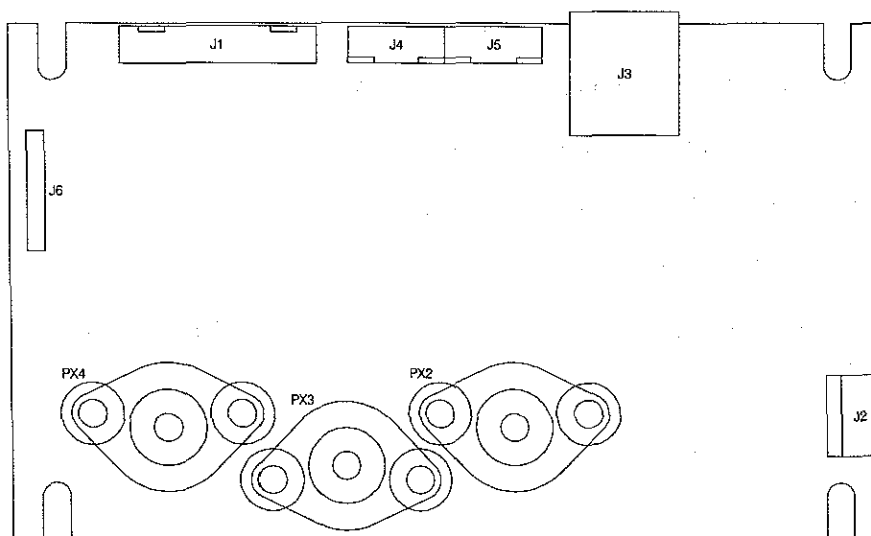


FIG. 7-10. Air Control Board GACU-2A

- J1 receives 5V DC Solenoid/Valve control voltages from Micro-Controller Board GMCU-2A.
 - Test suspect Air Control Board GACU-2A by replacing it with known good board.
 - Test suspect Micro-Controller Board GMCU-2A by replacing it with known good board.
- J2 receives 12V DC from Power Distribution Board GPDU-1A.
 - Test plug connected to J2 between pin 1 and 2 for 12V DC.
- J3 supplies pressure sensing signals to Micro-Controller Board GMCU-2A.
 - Ensure pneumatic tubing is properly connected.
 - Test suspect Air Control Board GACU-2A by replacing it with known good board.
 - Test suspect Micro-Controller Board GMCU-2A by replacing it with known good board.
- J4 supplies 12V DC to Left NC Solenoid/Valve and Left NO Solenoid/Valve.

- Test suspect Solenoid/Valve Assembly by replacing it with known good assembly.
- Test suspect Air Control Board GACU-2A by replacing it with known good board.
- Test suspect Micro-Controller Board GMCU-2A by replacing it with known good board.
- J5 supplies 12V DC to Right NC Solenoid/Valve and Right NO Solenoid/Valve.
 - Test suspect Solenoid/Valve Assembly by replacing it with known good assembly.
 - Test suspect Air Control Board GACU-2A by replacing it with known good board.
 - Test suspect Micro-Controller Board GMCU-2A by replacing it with known good board.
- J6 not used.
- PX2 is a pressure transducer that senses pressure in left pneumatic channel.
 - Ensure pneumatic tubing is properly connected.
 - Test suspect Air Control Board GACU-2A by replacing it with known good board.
- PX3 is a pressure transducer that senses pressure in Air Tank.
 - Ensure pneumatic tubing is properly connected.
 - Test suspect Air Control Board GACU-2A by replacing it with known good board.
- PX4 is a pressure transducer that senses pressure in right pneumatic channel.
 - Ensure pneumatic tubing is properly connected.
 - Test suspect Air Control Board GACU-2A by replacing it with known good board.

“GREEN BUTTON PUMP” MAJOR CIRCUIT BOARDS

PlexiPulse® Board OBS-1

The PlexiPulse® Board OBS-1 contains software that controls pump functions. It response to operator select options from the Membrane Panel and sends messages to the Membrane Panel for displays. The Micro-Controller also senses pressure in the pneumatic system and sends out control voltages to control the Solenoid/Valve. Refer to **FIG. 7-11**.

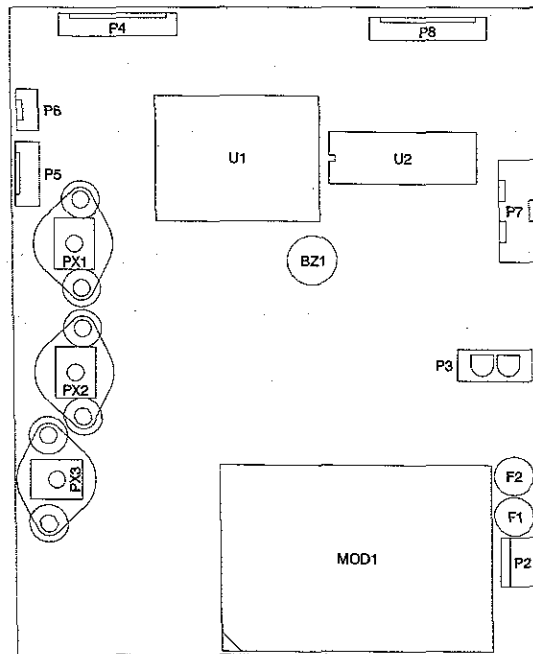


FIG. 7-11. PlexiPulse® OBS-1

- BZ1 is an audible alarm that sounds when Foot Wraps are not properly connected or Pump malfunctions.
- F1 250V, 1.25 amp slow blow fuse provides overcurrent protection of 115V AC supplied to board.
 - Unplug F1 and test for continuity (zero ohms) between pins on fuse.
- F2 250V, 1 amp slow blow fuse provides overcurrent protection of 115V AC supplied Compressor.
 - Unplug F2 and test for continuity (zero ohms) between pins on fuse.
- MOD1 is a power supply that converts 115V AC into 12V DC and 5V DC.
- P2 receives 115V AC when Power Switch is pressed.
 - Test plug connected to P2 for 115V AC between pin 1 and pin 2.
 - Test Power Switch by replacing it with known good switch.
- P3 supplies 115V AC to Compressor.
 - Test P3 for 115V AC between pin 1 and pin 2.
- P4 supplies 12V DC to Solenoid/Valves.
 - Test suspect Solenoid/Valve Assembly by replacing it with known good assembly.
 - Test suspect PlexiPulse® Board OBS-1 by replacing it with known good board.
- P5 not used.
- P6 supplies 12V DC to Fan.
 - Test P6 for 12V DC between pin 1 and pin 2.

- P7 supplies data messages to Membrane Panel for display on LCD.
 - Test suspect LCD by replacing it with known good unit.
 - Test suspect PlexiPulse® Board OBS-1 by replacing it with known good board.
- P8 receives operator selected options from Membrane Panel.
 - Test suspect Graphic Switch Panel by replacing it with known good unit.
 - Test suspect PlexiPulse® Board OBS-1 by replacing it with known good board.
- U1 is the microprocessor that controls all Pump functions.
- U2 is the EPROM that contains Pump software.

This chapter contains Scheduled Maintenance and Unscheduled Maintenance for the PlexiPulse® All-In-1 System, as well as pertinent warnings. Refer to the **Schematic Layout of Major PlexiPulse® Electrical and Pneumatic Components "Red Button Pump"** and **Schematic Layout of Major PlexiPulse® Electrical and Pneumatic Components "Green Button Pump"** and other illustrations provided in the **Replacement Parts Chapter**.

Information in this chapter should be used in conjunction with information provided in the Troubleshooting chapter of this manual.

It is recommended that all maintenance procedures in this chapter be performed only by qualified service technicians.

SCHEDULED MAINTENANCE

Scheduled maintenance on the PlexiPulse® All-In-1 System must be performed only by qualified service technicians at scheduled intervals while the Pump is in operation and after each patient placement. This maintenance includes the following steps.

1. Exercise the functions of the PlexiPulse® outlined in the **Check-Out Procedures** section of the **Preparation for Use** chapter and observe operation of the Pump. If there are abnormalities in the Pump operation, refer to the **Troubleshooting** chapter for remedies.
2. Inspect the PlexiPulse® Pump for wear or damage.
3. Replace unserviceable items with identical items.
4. Perform infection control procedures in the **Preparation For Use** chapter.

UNSCHEDULED MAINTENANCE

The PlexiPulse® All-In-1 System is made up of several components that should not be opened, disassembled, or otherwise modified by the user. These parts should be replaced as a unit. Removal and replacement instructions as well as electrical/pneumatic schematics and exploded drawings are provided for these assemblies. All assembly, operations, modification, maintenance, and repairs must be carried out only by KCI-authorized personnel.

NOTE: If a procedure is not described in a step-by-step method and is described as a single step only (i.e., "Remove Pump Case Rear Cover"), the detailed, step-by-step method can be found earlier in this **Unscheduled Maintenance** section.

The following Warnings and Cautions should be observed during all maintenance procedures.



High voltage equipment to be serviced by trained, qualified personnel only. Dangerous voltages can present a significant shock or burn hazard to personnel.



Power must be switched off and Power Cord unplugged prior to any maintenance procedure.



Carefully observe and mark locations and routing of all cables and tubing removed while performing the procedure in order to properly locate connections, cables and their tie-wraps during replacement. Wiring and tubing must be reinstalled exactly as before removal to insure unit operation.



Wear Ground Strap whenever handling Printed Circuit Boards and board components. An electrostatic discharge (ESD) may cause components to fail or operate erratically, possibly producing hazards for patient and staff.

Pump Case Rear Cover Removal/Replacement

1. Unplug Power Cord.
2. Lay Pump face down on a cushioned surface to prevent scarring the Pump Case.
3. Remove four Phillips-head Screws at Pump Case handle and at Case foot.
4. Lift and remove Rear Cover of Pump Case to expose Fan, Power Switch, Power Cord, Printed Circuit Board(s), Solenoid Valves, Manifold, and Compressor.
5. Reverse above described procedure to replace Pump Case Rear Cover.

NOTE: Do not overtighten screws securing Pump Case.

Circuit Breaker Removal/Replacement (Red Button Pump)

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Untwist cap on Circuit Breaker Holder.
4. Remove Circuit Breaker.
5. Reverse above described procedure to replace Circuit Breaker.

Power Cord Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Cut tie-wraps binding Power Cord wires.
4. Disconnect white wire and black wire on Power Cord from Power Switch.
5. Trace green ground wire to Compressor Mounting Plate and remove nut securing Power Cord ground wire to mounting plate.
6. Disconnect ground wire.
7. Remove Power Cord.

NOTE: It is not necessary to save Strain Relief as it is included with the replacement Power Cord.

8. Reverse above described procedure to replace Power Cord.

Power Switch Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove four spade connectors from back face of Power Switch and note wire positions on Switch.
4. Squeeze metal clips on each side of Power Switch and push switch through front of Pump Case.
5. Reverse above described procedure to replace Power Switch.

Fan Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove four Phillips-head Screws securing Fan Assembly to Standoffs.
4. Perform the following for your particular type of Pump:
 - A. Red Button Pump:**
 - 1) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 2) Disconnect Fan Cable from P6 on Power Distribution Board GPDU-1A.
 - B. Green Button Pump (with Solenoid/Valve/Manifold Assembly):**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.
 - C. Green Button Pump (with Solenoid/Valve/Fan Assembly):**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.
 - 4) Disconnect tubing from NC Solenoid/Valves and NO Solenoid/Valves.
5. Remove four Phillips-head screws, Nuts, and Washers that secure Fan to Mount Plate. Save mounting hardware for reuse.
6. Remove Fan.
7. Reverse above described procedure to replace Fan.

Printer Circuit Board Removal/Replacement

Red Button Pumps have four Printed Circuit Boards. Green Button Pumps have only one Circuit Board. See exploded view in the **Replacement Parts Manual** for identification of Circuit Board(s).

RED BUTTON PUMP

Power Distribution Board GPDU-1A Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Disconnect cables from Power Distribution Board GPDU-1A connectors:
 - GPDU/GMCU 8-pin Telephone Cable connected to P2.
 - GPDU/PSBU 2 Conductor Cable connected to P4.
 - GACU/GPDU 3 Conductor Cable connected to P5.
 - Fan Cable connected to P6.
 - GPDU/Power Switch 2 Conductor Cable connected to P7.
 - GPDU/Compressor 2 Conductor Cable connected to P8.
 - GPDU/PSBU 6 Conductor Cable connected to P9.
4. Remove two Phillips-head Screws securing Power Distribution Board GPDU-1A to Standoffs.
5. Remove circuit board.
6. Reverse above described procedure to replace Power Distribution Board GPDU-1A.

Power Supply Board PSBU-1 Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove Power Distribution Board GPDU-1A.
4. Disconnect cables from Power Supply Board PSBU-1 connectors:
 - GPDU/PSBU 2 Conductor Cable connected L and N.
 - GPDU/PSBU 6 Conductor Cable connected to P2.
5. Remove two Standoff and two Phillips-head Screws securing Power Supply Board PSBU-1 to Mounting Plate.
6. Remove circuit board.
7. Reverse above described procedure to replace Power Supply Board PSBU-1.

Air Control Board GACU-2A Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Disconnect cables from Air Control Board GACU-2A connectors:
 - GACU/GMCU 10-pin Cable connected to J1.
 - GACU/GPDU 3 Conductor Cable connected to J2.
 - GACU/GMCU 6-pin Telephone Cable connected to J3.
 - Solenoid Cable connected to J4.
 - Solenoid Cable connected to J5.
4. Disconnect tubing from pressure sensors:
 - Left Pneumatic Channel Tubing connected to PX2.
 - Air Tank Tubing connected to PX3.
 - Right Pneumatic Channel Tubing connected to PX4.
5. Remove four Phillips-head Screws securing Air Control Board GACU-2A to Standoffs.
6. Remove circuit board.
7. Reverse above described procedure to replace Air Control Board GACU-2A.

Micro-Controller Board GMCU-2A Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove Air Control Board GACU-2A.
4. Disconnect cables from Micro-Controller Board GMCU-2A:
 - GACU/GMCU 10-pin Cable connected to P1.
 - Membrane Panel Cable connected to P2.
 - GACU/GMCU 6-pin Telephone Cable connected to P3.
 - GPDU/GMCU 8-pin Telephone Cable connected to P4.
 - LCD/GMCU 14 Conductor Cable connected to P5.
5. Remove four Phillips-head Screws securing Micro-Controller Board GMCU-2A to Mounting Plate.
6. Remove circuit board.
7. Reverse above described procedure to replace Micro-Controller Board GMCU-2A.

GREEN BUTTON PUMP

PlexiPulse® Board OBS-1 Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Disconnect cables from PlexiPulse® Board OBS-1 connectors:
 - PlexiPulse® Board OBS Power Cable connected to P2.
 - Compressor Power Cable connected to P3.
 - Solenoid Cable connected to P4.
 - Fan Cable connected to P6.
 - LCD/GMCU 14 Conductor Cable connected to P7.
 - Membrane Panel Cable connected to P8.
4. Disconnect tubing from pressure sensors:
 - Left Pneumatic Channel Tubing connected to PX1.
 - Air Tank Tubing connected to PX2.
 - Right Pneumatic Channel Tubing connected to PX3.
5. Remove six Phillips-head Screws securing PlexiPulse® Board OBS-1 to Mounting Plate.
6. Remove circuit board.
7. Reverse above described procedure to replace PlexiPulse® Board OBS-1.

In-Line Filter/Dryer Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Perform the following for your particular type of pump:
 - A. Red Button Pump:**
 - 1) Remove four Phillips-head Screws securing Fan Assembly to Standoffs.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P5 on Power Distribution Board GPDU-1A.
 - 4) Remove Fan Assembly.
 - 5) Cut tie-wrap securing Dryer/Filter to Standoff.
 - B. Green Button Pump:**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.

4. Remove Filter/Dryer. Discard Filter/Dryer and replace with a new unit that has **white** filter paper, indicating the filter is new and in good condition.

NOTE: If the filter paper is **red**, the paper is saturated with moisture and should be replaced.

5. Reverse above described procedure to replace In-Line Filter/Dryer.

Compressor Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove four Phillips-head Screws securing Fan Assembly to Standoffs.
4. Perform the following for your particular type of Pump:
 - A. **Red Button Pump:**
 - 1) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 2) Disconnect Fan Cable from P6 on Power Distribution Board GPDU-1A.
 - B. **Green Button Pump (with Solenoid/Valve/Manifold Assembly):**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.
 - C. **Green Button Pump (with Solenoid/Valve/Fan Assembly):**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.
 - 4) Disconnect tubing from NC Solenoid/Valves and NO Solenoid/Valves.
5. Remove Fan Assembly.
6. Disconnect Compressor Power Cable from Printed Circuit Board at Spade Connectors.
7. Loosen four Phillips-head Screws that secure Compressor to Mount Plate.
8. Tilt compressor up and remove Phillips-head Screw securing green ground wire to Compressor.
9. Disconnect tubing connected between Compressor and Air Tank at Check Valve.
10. Remove Compressor from Pump Case.
11. Reverse above described procedure to replace Compressor.

Foam Air Filter Removal/Replacement

1. Unplug Power Cord.
2. Pinch center of Air Filter exposed on back of Pump Case and lift gently, pulling Filter up and away from case.
3. Replace Air Filter by inserting edge of Filter between outside face of Pump Case and Air Filter cage inside the Pump Case. Continue inserting filter around the opening until Filter lies smoothly.

Solenoid/Valve/Manifold Assembly Removal/Replacement

NOTE: This procedure applies to all Red Button Pumps and some Green Button Pumps.

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove four Phillips-head Screws securing Fan Assembly to Standoffs.
4. Perform the following for your particular type of pump:
 - A. Red Button Pump:**
 - 1) Remove Fan Assembly.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on Power Distribution Board GPDU-1A.
 - B. Green Button Pump (with Solenoid/Valve/Manifold Assembly):**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.
5. Unscrew and remove Left and Right Quick Disconnect couplings on front of Pump Case.
6. Disconnect tubing from IN ports on NC Solenoid/Valves and from Sense fittings on Manifold.
7. Disconnect Solenoid/Valve Cable from Circuit Board.
8. Remove Phillips-head Screw, Lock Washer and Flat Washer that secures the Solenoid/Valve/Manifold Assembly to the Pump Case.
9. Remove Solenoid/Valve/Manifold Assembly from Pump Case.

NOTE: Round Solenoid/Valves that appear in some Red Button Pumps are arranged and plumbed differently than rectangular Solenoid Valves. However, the Solenoid/Valve Replacement Kit, which contains rectangular Solenoid/Valves, will work regardless of which Valve is replaced.

NOTE: When round Solenoid Valves are replaced with rectangular Valves, move the two Expansion Tanks approximately 3 inches from the corners of the Pump Case to clear area between Fan Assembly Standoffs. Tie each Expansion Tank to a Standoff with Tie-wraps.
10. Reverse above described procedure to replace Solenoid/Valve/Manifold Assembly.

NOTE: Replace Quick Connect couplings using a leak sealant such as Leak-Lock.

Solenoid/Valve/Fan Assembly Removal

NOTE: This procedure is for only Green Button Pumps containing Solenoid/Valve/Fan Assembly.

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove four Phillips-head Screws securing Fan Assembly to Standoffs.
4. Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
5. Lift Fan Mounting Plate to expose Fan on under side of plate.
6. Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.
7. Disconnect tubing from NC Solenoid/Valves and NO Solenoid/Valves.
8. Remove Solenoid/Valve/Fan Assembly.
9. Reverse above described procedure to replace Solenoid/Valve/Fan Assembly.

Solenoid/Valve Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove four Phillips-head Screws securing Fan Assembly to Standoffs.
4. Perform the following for your particular type of pump:
 - A. Red Button Pump:**
 - 1) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 2) Disconnect Fan Cable from P5 on Power Distribution Board GPDU-1A.
 - 3) Remove Fan Assembly.
 - 4) Remove Solenoid/Valve/Manifold Assembly.
 - B. Green Button Pump (with Solenoid/Valve/Manifold Assembly):**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.
 - 4) Remove Fan Assembly.
 - 5) Remove Solenoid/Valve/Manifold Assembly.
 - C. Green Button Pump (with Solenoid/Valve/Fan Assembly):**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.

- 4) Disconnect tubing from NC Solenoid/Valves and NO Solenoid/Valves.
- 5) Remove Solenoid/Fan Assembly.
5. Cut tie-wraps binding Solenoid Cables together.
6. Note position of Solenoid wires in Solenoid Cable connector.
7. Remove two black wires from Solenoid Cable connector.
8. Reverse above described procedure to replace Solenoid/Valve Assembly.

Liquid Crystal Display (LCD) Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove four Phillips-head Screws securing Fan Assembly to Standoffs.
4. Remove Business Card Holder.
5. Perform the following for your particular type of pump:
 - A. **Red Button Pump:**
 - 1) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 2) Disconnect Fan Cable from P6 on Power Distribution Board GPDU-1A.
 - B. **Green Button Pump (with Solenoid/Valve/Manifold Assembly):**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.
 - C. **Green Button Pump (with Solenoid/Valve/Fan Assembly):**
 - 1) Cut tie-wrap securing Dryer/Filter to Fan Mounting Plate.
 - 2) Lift Fan Mounting Plate to expose Fan on under side of plate.
 - 3) Disconnect Fan Cable from P6 on PlexiPulse® Board OBS-1.
 - 4) Disconnect tubing from NC Solenoid/Valves and NO Solenoid/Valves.
6. Remove Fan Assembly.
7. If necessary, remove Solenoid/Valve/Manifold Assembly.
8. Remove Compressor.
9. Perform the following for your particular type of pump:
 - A. **Red Button Pump:**
 - 1) Remove Air Control Board GACU-2A.
 - 2) Disconnect:
 - Power Switch Cable connected to P7 on Power Distribution Board GPDU-1A.

- LCD/GMCU 14 Conductor Cable connected to P5 on Micro-Controller Board GMCU-2A.
- Membrane Panel Cable connected to P2 on Micro-Controller Board GMCU-2A.

B. Green Button Pump:

- 1) Remove PlexiPulse® Board OBS-1.

10. Remove four Phillips head screws near edges of Compressor Mount Plate at base of each Standoff.
11. On Green Button Pumps only, remove single Phillips-head Screw on side of Air Tank.
12. Trace green ground wire of Power Cord to Compressor Mount Plate and remove nut securing Power Cord ground wire and Membrane Switch Assembly ground shield to Compressor Mount Plate.
13. Lift and remove the Air Tank Assembly from the Pump Case.
14. Remove four plastic cushions from screw receptacles underneath Mount Plate.
15. Remove four Phillips-head Screws securing LCD to Pump Case.
16. Remove LCD and four Spacers.
17. Reverse above described procedure to replace LCD.

Membrane Switch Assembly Removal/Replacement

1. Unplug Power Cord.
2. Remove Pump Case Rear Cover.
3. Remove Membrane Cable from appropriate circuit board.
4. To remove Membrane Panel peel away from Pump Case.

NOTE: *Membrane Switch Assembly is glued in place, but will separate from front of Pump Case when pressure is applied.*

5. On Red Button Pumps only, remove Decal Border, if present.
6. Reverse above described procedure to replace LCD.

Electrical Safety Readings

There are no external points on the PlexiPulse® All-In-1 Pump for taking electrical safety readings (ground readings) of the Pump. The preferred method for taking ground readings is done inside the Pump Case; however, to take safety readings without opening the case, proceed as follows:

1. Remove Air Filter from back of Pump Case.

NOTE: *No visible metal Fan Guards or screws are grounded.*

2. Slide the tip of a screwdriver along the flat black Fan Mount Plate beneath the black foam insulation to a Mount Plate screw at the bottom center (approximately) of the opening.

NOTE: *This screw is grounded through the Fan Mount Plate Standoff to the Compressor Mount Plate.*

3. When the screwdriver is in contact with the screw, attach the Kelvin Clip of an analyzer to the screwdriver and take electrical safety readings.

Pump Dimensions **12" L x 10 3/4" W x 7" D**
Pump Weight **11 lbs.**
Compressor Operating Pressure **717 - 1150 mm Hg**
Maximum Output Pressure **180 +15/-20 mm Hg**

ELECTRICAL DATA

Voltage **115V AC**
Frequency **60 Hz**
Maximum Current Consumption **0.33 Amp**
Maximum Electrical Leakage **Less than 100 microamps**
Power Cord **16 ft. Hospital Grade**

* Specifications are subject to change without notice.

The following replacement parts are available for repair and maintenance of the PlexiPulse® All-In-1 System. Refer to the drawings at end of this chapter to identify and locate the following replacement parts.

NOTE: QTY. refers to how many of a component are found in the specific area of one PlexiPulse® Pump. On illustrations, the quantity also refers to how many of a component are found in the specified area of one PlexiPulse® Pump. For example, if a quantity of (4) is indicated, there may be more of the same screw indicated in other areas of the product.

DESCRIPTION	PART NO.	QTY.
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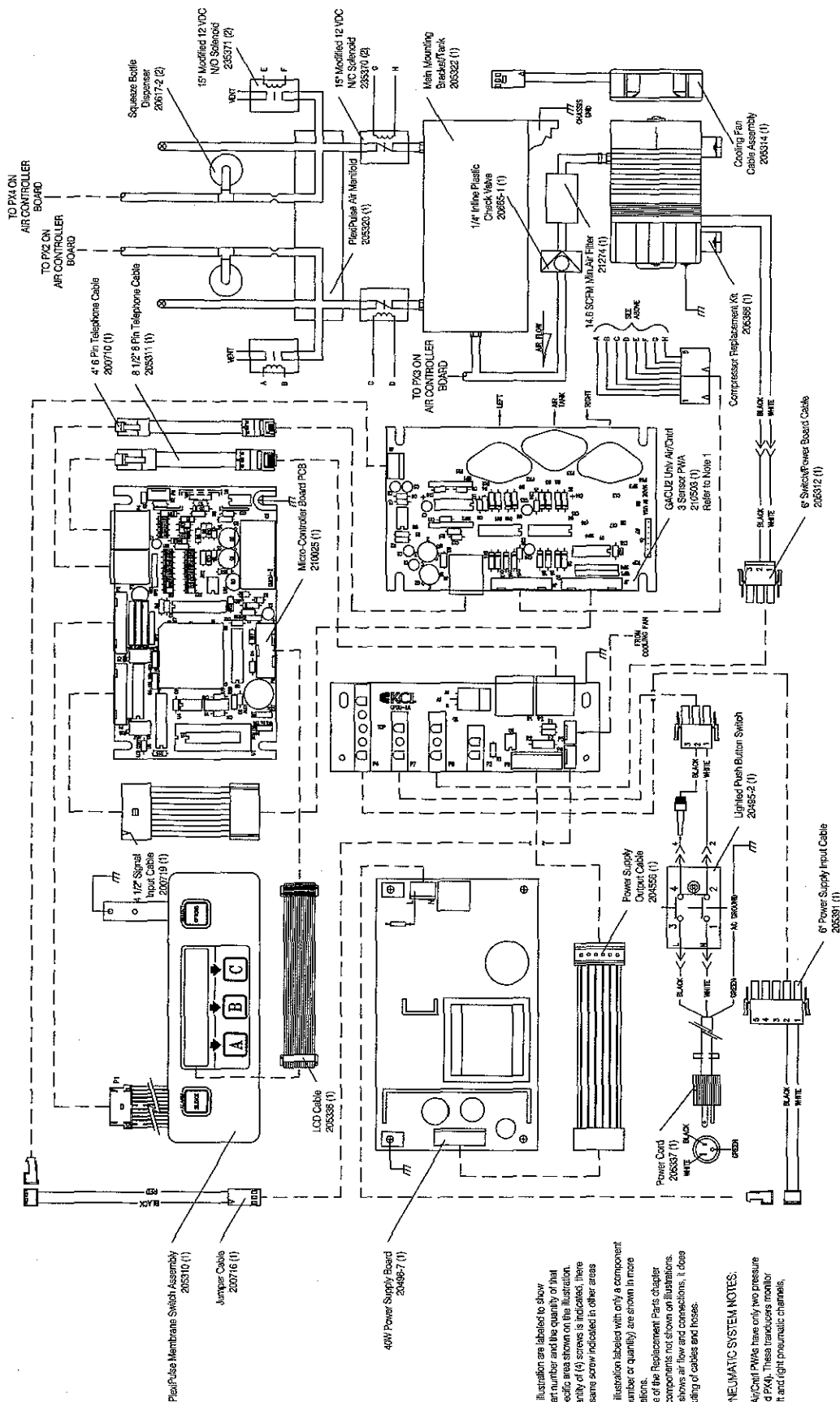
MAJOR ASSEMBLIES

PlexiPulse® Pump	205300	1
Universal Calf Wrap (10 ea.)	28900000	1
Foot and Calf Combo Wrap (3 pair)	28900001	1
Extension Kit (20 ea.)	28900004	1
Left and Right Foot Wrap (5 pair)	28900016	1

MISCELLANEOUS

Adhesive, Sealant GE RTV 162	20993-1	-
Sealant, Leak Lock	20984-1	-
Varnish, Red GLTP	20985-1	-

* Replacement parts are subject to availability.



GENERAL NOTES:

- Components on this illustration are labeled to show component name, part number and the quantity of that component in the specific area shown on this illustration. For example, if a quantity of (5) screws is indicated, there may be more of the same screw indicated in other areas of the product.
- Components on this illustration labeled with only a component name (with no part number or quantity) are shown in more detail on other illustrations.
- Refer to the first page of the Replacement Parts chapter for part numbers of components not shown on illustrations.
- This schematic only shows air flow and connections. It does not show specific routing of cables and hoses.

ELECTRICAL AND PNEUMATIC SYSTEM NOTES:

- Some GACUZ Univ Air/Out PWAs have only two pressure transducers (P12 and P14). These transducers monitor air pressure in the left and right pneumatic channels, respectively.

Figure 1-1. Schematic Layout of Major PlexiPulse® Pump Electrical and Pneumatic Components
(Red Button Pump)

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10-3

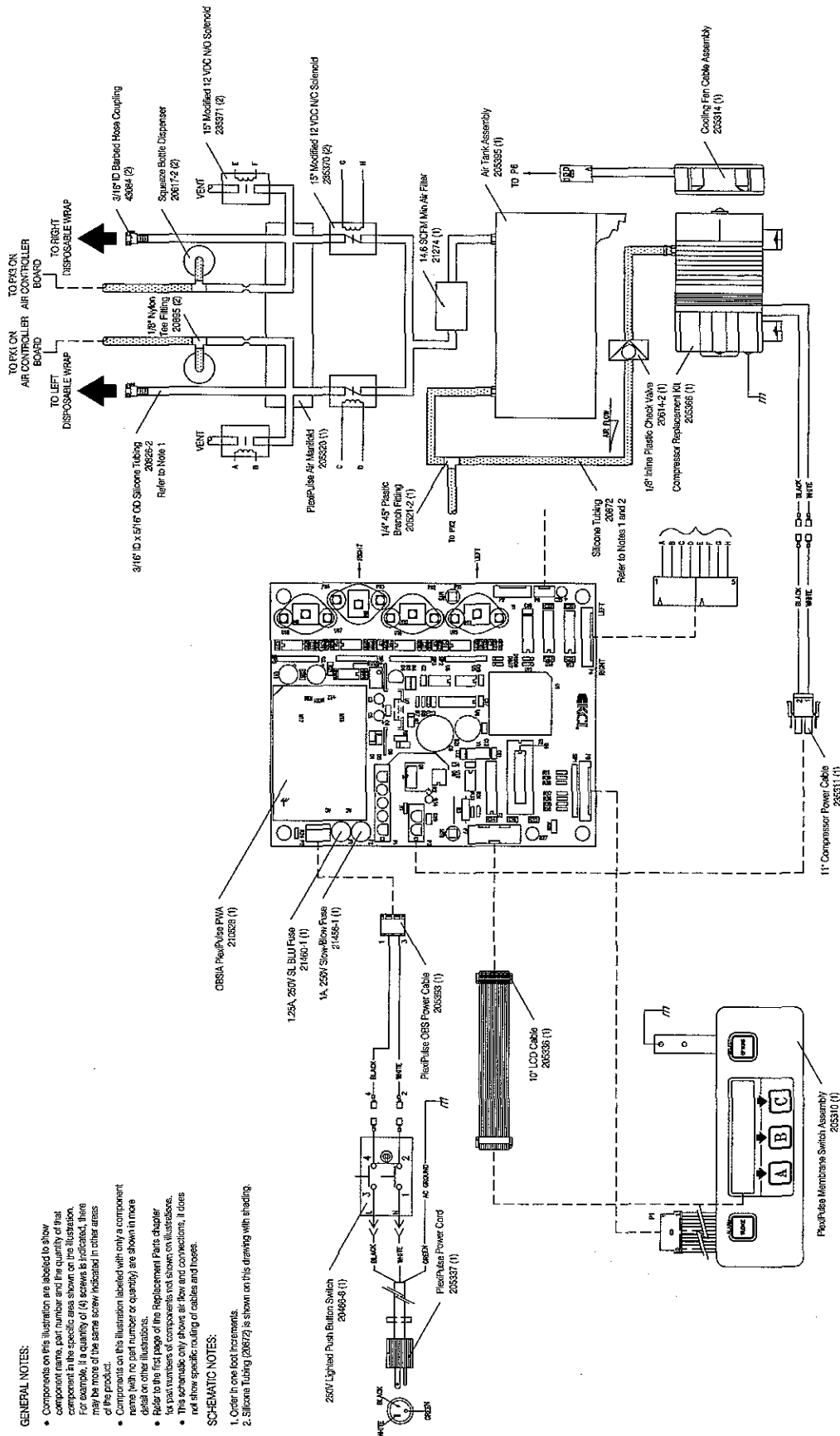
Replacement Parts

**Figure 1-2. Schematic Layout of Major PlexiPulse® Pump Electrical and Pneumatic Components
(Green Button Pump with Solenoid/Valve/Manifold Assembly)**

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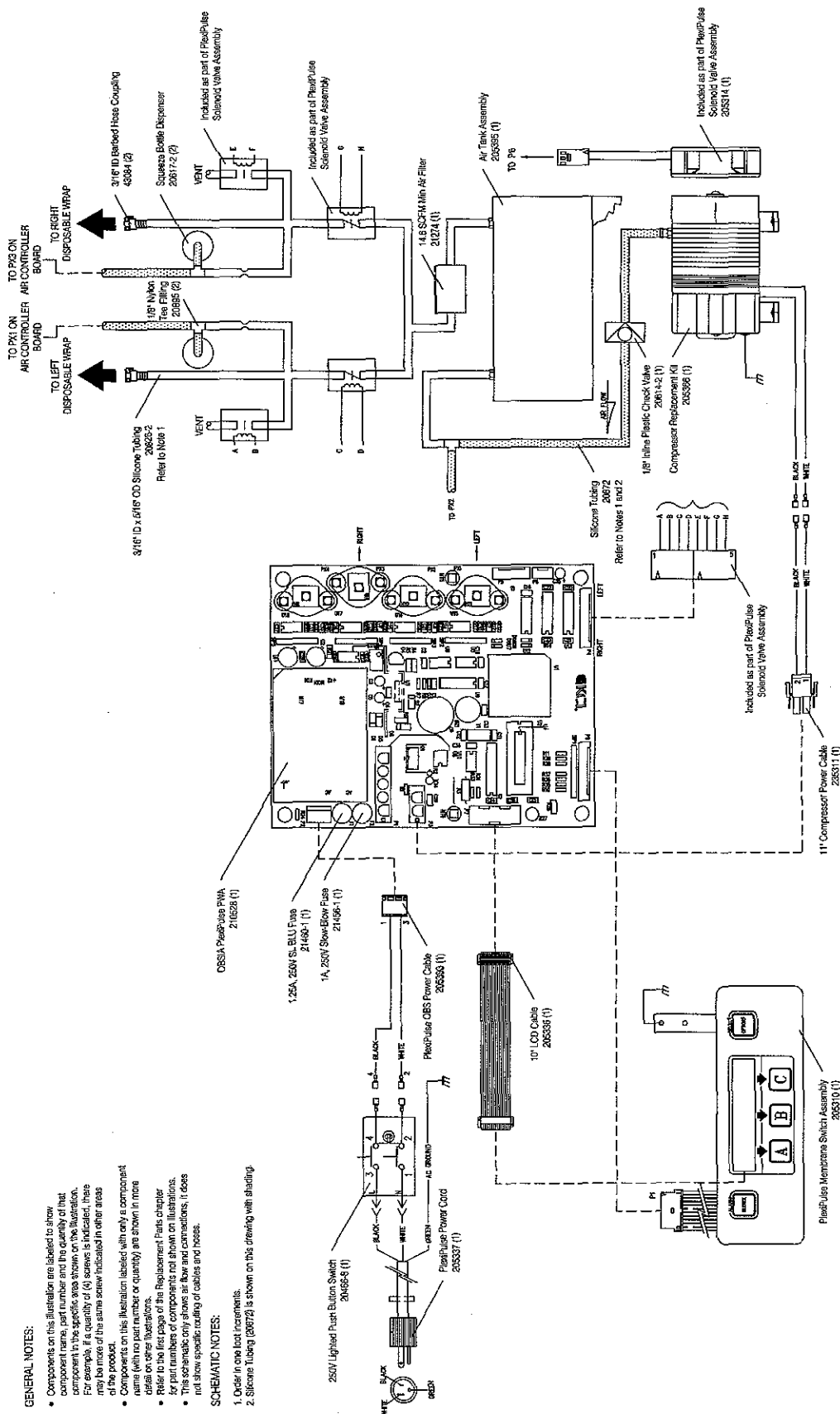


Figure 1-3. Schematic Layout of Major PlexiPulse® Pump Electrical and Pneumatic Components
(Green Button Pump with Solenoid/Valve/Fan Assembly)

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10-5

Replacement Parts

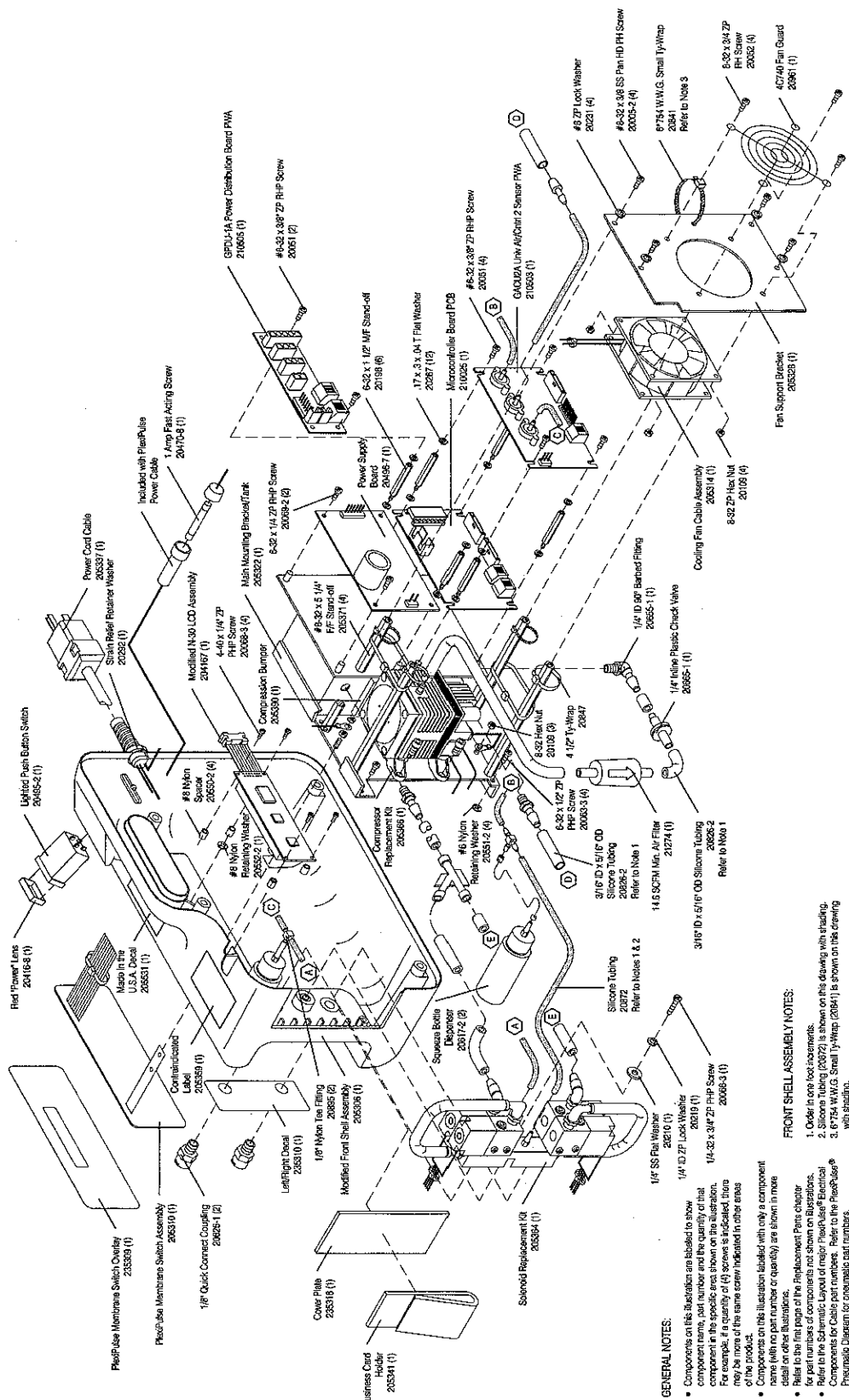


Figure 1-4. Exploded View of the PlexiPulse® Pump Front Shell Assembly (Red Button Pump)

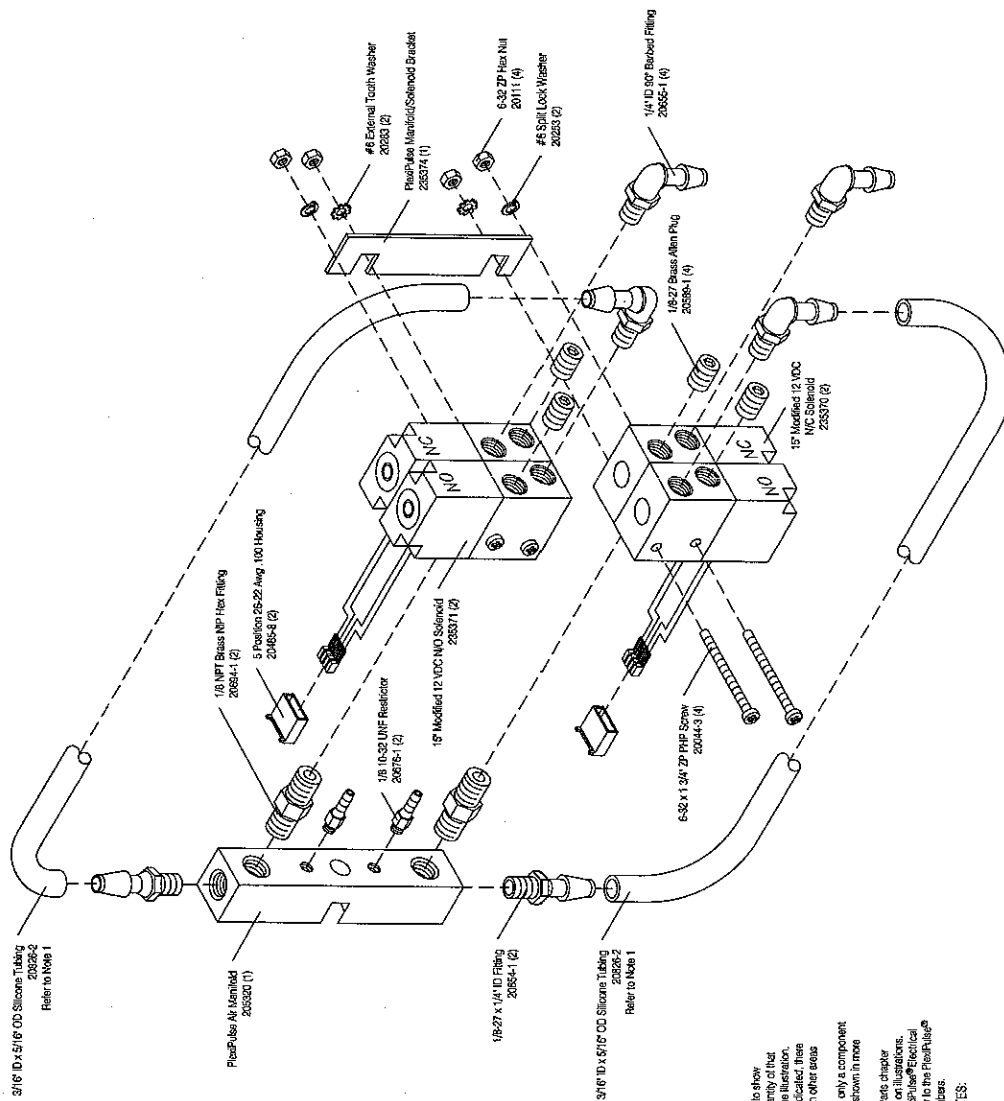
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Replacement Parts

Figure 1-7. Exploded View of the PlexiPulse® Pump Solenoid/Valve/Manifold Assembly



GENERAL NOTES:

- Components on this illustration are labeled to show component name, part number and the quantity of that component. The quantities shown on this illustration, for example, 1 of each, are for reference only. They may be more of the same screw indicated in other areas of the product.
- Components on this illustration labeled with only a component name (with no part number or quantity) are shown in more detail on other illustrations.
- Refer to the first page of the Replacement Parts chapter for part numbers of components not shown on illustrations.
- Refer to the Section 4.0 Capabilities of major PlexiPulse® Electrical Components for more information on the PlexiPulse® Pneumatic Diagram for pneumatic part numbers.

MANIFOLD/SOLENOID ASSEMBLY NOTES:

- Order in one foot increments.

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